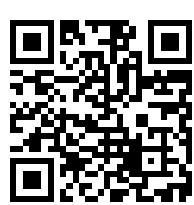
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INGERSOLL-RAND PRODUCTS

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Form No. 9207
Superseding 9107
First Edition
January, 1921



Ingersoll-Rand Company

EXECUTIVE OFFICES

11 Broadway New York

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55612A

We have endeavored in this condensed catalogue to give a general idea of the numerous products manufactured by the Company. For easy reference these have been subdivided into various classifications.

It being impossible to include within the limited scope of this book all of the detailed information which the intending purchaser requires and should have, individual bulletins are available. These are cited in each case and we solicit requests for them.

Particular attention is called to the Engineering Data Section, as it will be found of value in solving every-day pneumatic problems; it may also often help in determining exact requirements for new equipment.

It is the Company's earnest desire that all should feel free to consult at any time with its Engineering Departments at the Executive Offices, 11 Broadway, New York City, or at any of its numerous branch houses throughout the world.

In order to assure prompt service all communications should be addressed to the Company's nearest office, as shown on the following page.

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PRODUCTS CATALOG

Ingersoll-Rand Products

Air Compressors

Stationary

- **Steam Drive**
 - Straight Line FR
 - Imperial Duplex (Type X)
 - Imperial Duplex (Type XPV)
 - Duplex Corliss—ORC
- **Electric Drive**
 - Short Belt Type (FR; Imp. XB&14)
 - Direct Connected (PRE; XYE)
- **Power Drive**
 - ER
 - Imperial XB, XYB & 14

Portable

- **Tie Tamper Cars**
 - Electric
 - Gasoline
- **Mine Car Wagon**
 - Steam Drive
 - Electric Drive
 - Gasoline Drive
- **HIGH PRESSURE**
 - Straight Line, 2 & 3 Stage
 - Imperial 2, 3 & 4 Stage
 - ORC 2, 3 Stage

Air Compressor Accessories
- Aftercoolers
- Intercoolers
- Receivers
- Reheaters
- Fusible Signal Plugs

Turbo Compressors and Turbo Blowers

Gas Compressor Equipment
- Gas Cylinders only
- Compressors Complete

Gasoline Extraction Compressors
- Straight Line, ER & FR
- Duplex Compound XYB-1 & 2
- Boosters and Vacuum Pumps
- Expanders, FR & XPV
- Type XII Testers

Gasoline Extraction Compressor Accessories
- Separating Receivers for Gas Inlet
- Gasoline Separating Receivers
- Aftercoolers

Dry Vacuum Pumps
- ER & FR
- Imperial XB-X-XPV-14

Tie Tampers

Tie Tamper Compressor Cars
- Gasoline Engine Driven
- Electric Driven

Tie Tamper Accessories

Cameron Pumps

Direct-Acting
- Type "GSS" (Boiler Feed)
- Type "ELS" (Long Stroke Boiler Feed)
- Type "CPS" (Gritty Water)
- Type "LSS" (Light Service)
- Type "VPS" (Sinking)
- Vertical Marine Pumps

Centrifugal
- Single Stage
 - Class "SV"
 - Class "FV"
 - Class "OFV"
 - Class "DV"
 - Class "ODV"
 - Class "LDV"
 - Class "VDV"
- Multi-Stage
 - Class "MT"
 - Class "MS"
 - Class "BT"
 - Class "ST"

Condensers
- Low Level Jet
- Barometric
- Surface

Coal Cutters
- Punchers
- Radialaxe
- Picks (56-H)

Steam Engines—FP

Air Lift Pumps

Return Air Pumping Systems

Sergeant Ticket Cancelling Boxes

Oil Engines
- Marine
- Stationary

Portable Hoists
- Little Tugger 1H, 1HS, 11H, 11HS, 5H, 5HS.

Spike Driver Type CC-250

Electric—Air Track Channeler 7"

Stone Working Tools

DRILLS Jackhamer
- DDR-13 & DDRW-13
- DCR-13 & DCRW-13
- BCR-430 & BCRW-430
- BBR-13 & BBR-130
- BAR-33

DRILLS

Hammer
- Paving Breaker
 - BC-25
 - CC-25
 - BC-20, 21, 22
 - BCW-22—BC-21W2
 - CA-21—CAW-21
- Stopehamer
 - CC-10, 11, 12, 20, 21, 22
 - CCW-12
 - CC-21W2
- Clinker Breaker CC-27
- Leyner-Ingersoll Drifters
 - 18 & 26
 - 148, 248, 448

Piston
- Plugs Imperial MV-1 & 2
- Butterfly C110, C113, C111, C116, D110, D113
- Sergeant Auxiliary Valve A86, B24, C24, D24, D44, E24, E44, F24, F194
- Submarine G107, G108, G109, H9, H64, K64
- Electric Air—4E
- Hand Drive

Core—Calyx
- Horsepower Drive
- Gasoline Drive
- Power Drive
- Steam Drive

Mountings
- Tripods A27, A86, B27, D27, E27, F27, G27
- Columns Single & Double Screw
- Jackhamer Mountings
 - JB-10
 - JC-10
 - JC-11
 - JD-10
 - JC-40
- Gadder Frames
- Quarry Bars

Drill Accessories
- Drill Steel
- Hose
- Hose Couplings and Menders
- Manifold and Headers
- Sand Pumps
- Sprayers
 - "Dustkiler"
 - Barnet
 - Ham. Drill, WS-2 & 4
 - Jackhamer
- Throttles and Oilers
- Water Tanks

Machine Drill Steel Sharpeners
- Leyner Jacksteel No. 33
- Leyner Sharpener No. 4
- Leyner Sharpener No. 50

Machine Sharpener Accessories

Furnaces
- Leyner Oil Furnace No. 3
- Leyner Oil Furnace No. 24
- No. 3 Preheating Furnace
- No. 8-B Coke Forge

Steel Finishing Machines
- Leyner Shank and Bit Punch
- IRB1 Bit Punch
- Leyner Pedestal Grinder

Hand Drill Steel Sharpening Tools
- For Jackhamer and Ley. No. 26 Shanks
- For Leyner No. 18 Shanks
- For 4-Pt. Cross Bit
- For 6-Pt. Bit
- For X Bit
- For Carr Bits

Pneumatic Tools

Drills
- Chipping Hammers
- Metal Workers
 - Reversible
 - Non-Reversible
- Wood Borers
- Close Quarter
- Light Service

Riveters
- Hammers
- Jam Riveters
- Holders-On

- Little David Sand Rammers
 - Bench
 - Floor
- Calking Machines
- Drift Bolt Drivers
- Grinder and Saw
- Little David Hoists
- Rammers, Types 12-SR & 22-SR
- Stationary Motors

Pneumatic Tool Accessories
- Antipeel Hose
- Little David Hose Couplings
- Menders and Clamps
- Rivet Sets
- Chisels and Chisel Blanks
- Drill Chucks

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Japan, Kobe—American Trading Co.
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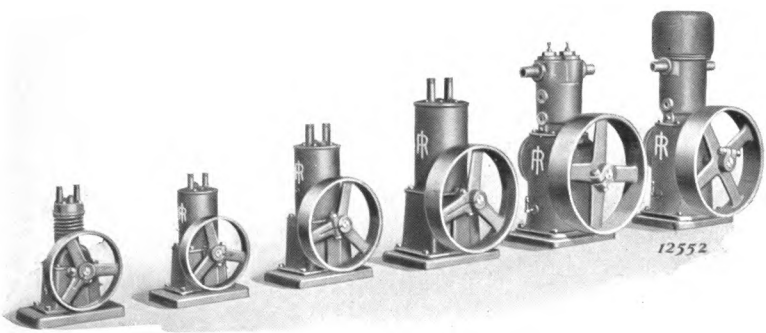
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"Imperial Type Fourteen" Air Compressors Power Driven

Continuous Air Pressure 60 to 100 Pounds
Intermittent Air Pressures up to 150 Pounds



These compressors are vertical, single-stage, single-acting, power driven machines. They are of enclosed construction, having automatic splash lubrication, and center cranks. Mushroom type inlet and discharge valves are used on the 3″, 4″ and 5″ stroke sizes. Ingersoll-Rand plate inlet and discharge valves are furnished on the 6″ stroke machines.

With the exception of 3″ stroke compressors, they can be supplied with automatic unloaders, which load and unload compressors at a predetermined air receiver pressure.

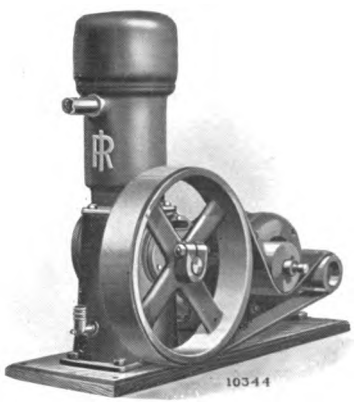
Bulletin 3039.

Cylinder Inches		Method of Cooling	Speed R.P.M.	Piston Displacement Cu. Ft. per Min.	B. H. P. Required at Belt Wheel			Belt Wheel Inches		Overall Dimensions with Tight Pulley Only Inches			Length with Tight and Loose Pulleys Inches
					Air Pressure								
Dia.	Stroke				60	80	100	Dia.	Face	Length	Width	Height	
2½	3	Air Cooled	700	6	.96	1.01	1.05	12	2¼	12	12	16	13½
2½	3	Res. Cooled	700	6	.96	1.01	1.05	12	2¼	12	12	17½	13½
3½	4	Res. Cooled	550	12.2	2.8	2.9	3	16	3¼	14	16	23	17
4½	5	Res. Cooled	500	23	4	4.15	4.35	20	4½	17	20	30	21½
6	6	Res. Cooled	450	44	6.9	7.5	8.0	24	5½	21	24	46	25½
6	6	Circ. Water Cooled	450	44	6.9	7.5	8.0	24	5½	21	24	39	25½

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"Imperial Type Fourteen" Air Compressors Short Belt Electric Driven

Continuous Air Pressures 60 to 100 Pounds
Intermittent Air Pressures up to 150 Pounds



Standard compressors as shown above are equipped with short belt drive attachment having floating idler pulley, and are connected to a standard electric motor. They are furnished complete with motor, sub-base, endless belt and idler attachment.

With the exception of 3" stroke compressors, they can be supplied with automatic unloaders, which load and unload compressors at predetermined air receiver pressure.

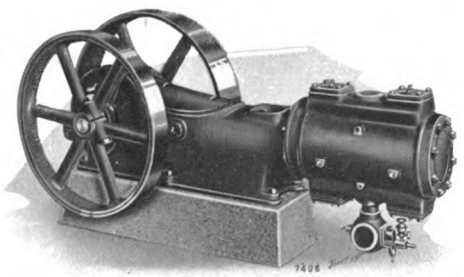
Bulletin 3039.

Compressor Size	Speed Rev. per Min.	Piston Displacement Cu. Ft. Free Air per Min.	Horse Power of Motor Supplied	Overall Dimensions, Inches			Alternating or Direct Current	Type and Phase	Voltage
				Length	Width	Height			
2½x3	700	**6.0**	1½	31	15½	17½	A. C.	Single Phase	110-220
							A. C.	2-3 Phase Squirrel Cage	110-220-440
2½x3	700	**6.0**	1½	31	15½	19	D. C.	Compound Wound	115-230
3½x4	550	**12.2**	3	38	17½	24½	A. C.	Single Phase	110-220
							A. C.	2-3 Phase Squirrel Cage	110-220-440
							D. C.	Compound Wound	115-230
4½x5	500	**23.0**	5	45	22	31½	A. C.	Single Phase	110-220
							A. C.	2-3 Phase Squirrel Cage	110-220-440
							D. C.	Compound Wound	115-230
6x6	450	**44**	10	53	29	40½	A. C.	Single Phase	110-220
							A. C.	2-3 Phase Squirrel Cage	110-220-440
							A. C.	2-3 Phase Slip Ring	110-220-440
6x6	450	**44**	10	53	29	47½	D. C.	Compound Wound	115-230

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Class "ER-1" Power Driven Compressors

Discharge Pressures 10 to 125 Pounds



Single-stage, double-acting, straight-line compressors arranged for belt drive. The running parts are enclosed, removable covers affording instant access for inspection. Running parts and main bearings are lubricated by an automatic splash system, a sight feed oiler supplying the air cylinder. The inlet and discharge valves are of the Ingersoll-Rand plate type, with liberal port areas and noiseless in operation. Reliable regulators, automatically loading and unloading compressor, can be supplied for all sizes.

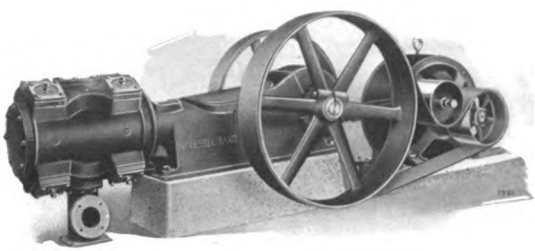
These compressors can be furnished with short belt drive attachment (see page 4) or with tight and loose pulleys for shaft drive. Bulletin 3330.

Cyl.		R.P.M.	Piston Displ. in Cu. Ft. per Min.	Air Pressure		Brake H.P. including Belt Loss		Belt Wheel		Overall Dimensions Feet and Inches			Approx. Shipping Weight—Pounds				Approximate Length of Motor Driven Units
													Complete Compr.				
Diam.	Stroke			Min.	Max.	Min.	Max.	Diam. Inches	Face Inches	Length	Width Inches	Height from Floor	Domestic	Export	Rail and Water	Addition for SBD&B	
4	4	500	**28**	100	150	4	4.3	20	4½	4–7	1–6	2–10	600	800	700	45	6–0
5	4	500	**44**	20	100	3.8	6.5	20	4½	4–10	1–6	2–10	620	820	720	45	6–0
6	4	500	**64**	—	20	—	6.3	20	4½	5–1	1–6	2–10	650	850	750	45	6–0
5	5	400	**44**	100	150	6.5	7	28	5½	6–2	1–9½	3–4	1100	1350	1225	55	7–9
6	5	400	**64**	45	100	7.3	9.3	28	5½	6–6	1–9½	3–4	1150	1400	1275	55	7–9
7	5	400	**88**	—	45	—	10	28	5½	6–9	1–9½	3–4	1250	1500	1375	55	7–9
6	6	350	**67**	100	140	10	10	36	5½	6–6	1–11	3–10	1715	2050	1865	55	9–11
7	6	350	**92**	45	100	11	13	36	5½	6–7	1–11	3–10	1765	2100	1970	55	10–1
8	6	350	**120**	25	45	13	15	36	5½	6–7	1–11	3–10	1850	2235	2165	55	10–1
9	6	350	**154**	9	25	9	15	36	5½	6–9	1–11	3–10	1990	2400	2175	55	10–2
12	6	350	**274**	—	9	—	15	36	5½	6–10	1–11	3–10	2275	2875	2700	55	10–3
8	8	250	**113**	100	130	19	21	45	8½	7–11	2–6¼	4–2½	2995	3550	3220	110	12–4
9	8	250	**145**	65	100	21	24	45	8½	8–1	2–6¼	4–2½	3125	3670	3335	110	12–6
10	8	250	**179**	30	65	19	25	45	8½	8–4	2–6¼	4–2½	3310	3950	3575	110	12–9
12	8	250	**258**	17	30	7	24	45	8½	8–2	2–6¼	4–2½	3300	3800	3685	110	12–6
14	8	250	**354**	—	17	—	24	45	8½	8–4	2–6¼	4–2½	4000	4300	4300	110	12–9
10	10	250	**223**	100	120	39	42	58	10½	9–9	3–2¼	5–1	4800	5700	5140	225	14–4
12	10	250	**324**	50	100	43	57	58	10½	9–5	3–2¼	5–1	4900	6100	5270	225	14–0
14	10	250	**441**	25	50	38	56	58	10½	9–8	3–2¼	5–1	5690	6560	5900	225	14–3
17	10	250	**655**	—	25	—	56	58	10½	9–11	3–2¼	5–1	6950	7955	7225	225	14–5
12	12	220	**340**	100	115	60	62	72	14½	11–0	4–1¾	6–3	7000	8315	7550	375	16–4
14	12	220	**464**	40	100	57	74	72	14½	11–3	4–1¾	6–3	7650	8975	8220	375	17–0
17	12	220	**688**	20	40	52	76	72	14½	11–4	4–1¾	6–3	8600	10100	9350	375	16–8
20	12	220	**955**	—	20	—	77	72	14½	11–6	4–1¾	6–3	9600	11300	10450	375	16–7

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Class "ER" Straight-Line Compressors Short Belt Electric Driven

Discharge Pressures 10 to 125 Pounds



Standard "ER" Compressors as listed on page 3 may be equipped with short belt drive attachment with floating idler, and endless belt for connection to standard electric motor. This arrangement affords a material saving in floor space, requires a shorter belt, and increases the arc of belt contact.

Class "ER" Electric Driven Compressors are furnished complete, ready for installation on simple foundation. The equipment comprises: compressor, motor with starter and motor pulley, short belt attachment with idler and endless belt.

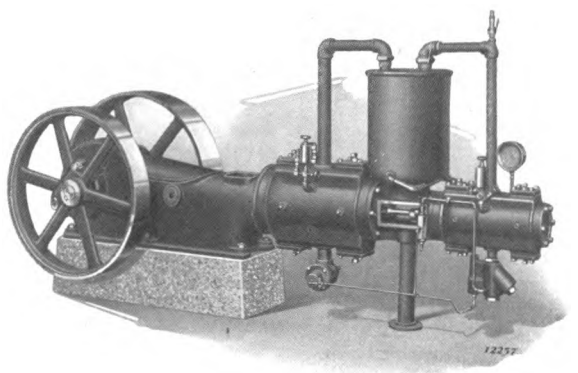
The compressor regulation depends upon the individual requirements and the size of the unit. This regulation automatically controls air output in accordance with the demand.

In asking for prices kindly specify electric current conditions.

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Class "ER-2" Straight-Line Compressors Power Driven

Discharge Pressures 150 to 250 Pounds



These compressors are especially designed for high pressure service either for air, gas or for the extraction of gasoline from natural gas. The frames and running parts are the same as used on Class ER Compressors previously described.

The compressor cylinders are two-stage, the high and low pressure cylinders are arranged in tandem and are double acting. The inlet and discharge valves are of the Ingersoll-Rand plate valve type. The intercooler is of simple coil construction and is mounted on the distance piece separating the high and low pressure cylinders. When used for gasoline extraction service no intercooler is furnished.

The cylinders are lubricated by means of a force feed lubricator.

These units can be furnished with standard belt wheel, short belt drive or with tight and loose pulleys.

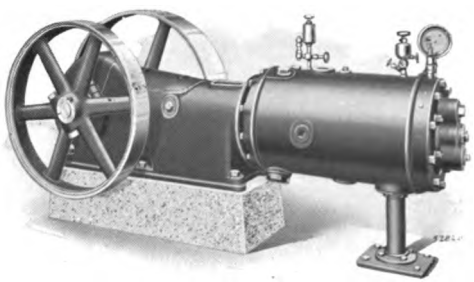
Where desirable regulators can be furnished.

Full information on request.

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Class "NNE-2S" Straight-Line Compressors Power Driven

Discharge Pressures 150 to 500 Pounds



These two-stage, single-acting, straight-line compressors for air pressures up to 500 pounds have main frames, running parts and main bearings similar to Class "ER" Compressors described on pages 3 and 4. The air cylinders are lubricated by a force-feed lubricator, while the main bearings and running parts are lubricated by the automatic splash system. The smaller size units have jacket type intercooler, "Direct Lift" poppet inlet valves, and "Cushioned Direct Lift" poppet discharge valves. Larger units have overhead intercooler, mounted above the low and high pressure air cylinders, "Hurricane Inlet" valves and "Cushioned Direct Lift" discharge valves.

These compressors can be furnished with suitable air unloaders if desired.

Class "NNE-2S" compressors can be furnished with short belt drive attachment or with tight and loose pulleys.

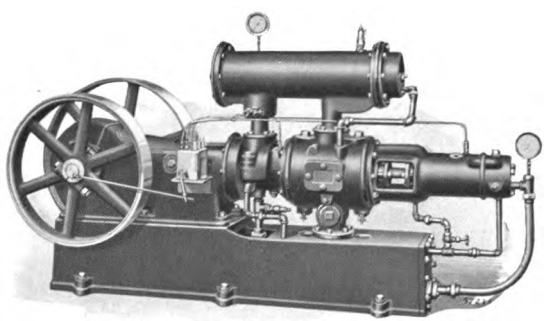
Full information on request.

Piston Displacement Cu. ft. free air per min.	Discharge Pressures lbs. per sq. in.	Floor Space—Feet and Inches		
		Length	Height	Width
37	150–200	7–5	3–3	1–11
83	150–200	8–8	3–11	2–6
165	150–200	10–5	4–6	3–0
284	150–200	12–8	5–9	4–1
31	200–350	7–5	3–3	1–11
67	200–350	8–8	3–11	2–6
120	200–350	10–6	4–6	3–0
217	200–350	12–8	5–9	4–1
26	350–500	7–5	3–3	1–11
60	350–500	8–8	3–11	2–6
118	350–500	10–7	4–6	3–0
187	350–500	12–8	5–9	4–1

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Class "NNE-3" Straight-Line Compressors Power Driven

Discharge Pressures 550 to 2500 Pounds



Three-stage, straight-line, power driven compressors for discharge pressures ranging from 550 to 2500 pounds. Compressor frame and running parts are the same as for Class "ER" units (page 3). The low pressure air cylinder is double-acting, the intermediate and high pressure cylinders single-acting, all being oiled by a force feed lubricator having separate oil feed to each cylinder. Overhead intercooler is located between low pressure and intermediate cylinders, while another cooler of coil construction is located between intermediate and high pressure cylinders in sub-base. All inlet valves are of the "Direct Lift" poppet type and discharge valve are "Cushioned Direct Lift" poppet type. The compressor is complete with necessary pressure gauge and safety valves on intercoolers.

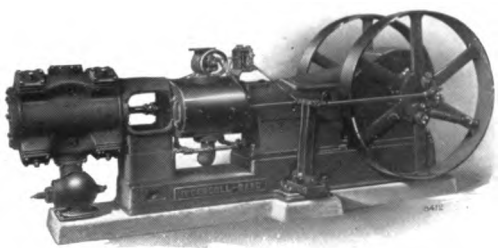
Class NNE-3 units can be equipped with short belt drive, or with tight and loose pulleys.

For further information as to sizes, capacities, etc. please refer to Company's New York Office.

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Class "FR-1" Steam Driven Compressors

Steam Pressures 80 to 175 Pounds
Discharge Pressures 10 to 125 Pounds



Single-stage, double-acting, straight-line steam driven compressor, having piston valve steam cylinder located between main frame and compressor cylinder. All running parts are enclosed, removable covers affording instant access for inspection. Driving parts and main bearings are lubricated by an automatic splash system, and steam and compressor cylinders by force feed lubricator. Inlet and discharge valves are of the Ingersoll-Rand plate type. The balanced piston steam valve permits the use of superheat and high steam pressures as well as saturated steam. When used in conjunction with our automatic cut-off fly wheel governor, steam economies are obtained which far exceed those obtainable with compressors using flat type of slide valve and throttle governor.

Class "FR" Compressors are furnished with either automatic cut-off fly wheel governor, or with adjustable speed throttling governor. Suitable regulators for compressor cylinder are also supplied if required. Bulletin 3131.

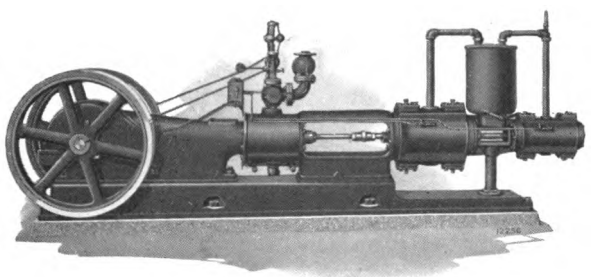
Size of Cylinders—Inches				R.P.M.	Piston Displ. Cu. Ft. per Min.	Air Pressure Designed For	I. H. P. in Steam Cylinder	Diam. Fly Wheels Ft. In.	Overall Dimensions Feet and Inches		
Diameter			Stroke						Length	Width	Height from Floor
Steam		Air									
Steam Press. 80–120 lbs.	Steam Press. 125–175 lbs.										
7	6	6	6	350	67	80–125	9–10	2–4	8–2	2–3	3–6
7	6	7	6	350	92	55–100	11–13	2–4	8–3	2–3	3–6
7	6	8	6	350	120	30–50	12–14	2–4	8–3	2–3	3–6
7	6	9	6	350	153	15–25	11–14	2–4	8–4	2–3	3–6
7	6	12	6	350	273	–10	–16	2–4	8–5	2–3	3–6
9	8	8	8	300	136	80–125	21–25	3–3	10–2	2–8	4–0
9	8	9	8	300	173	65–100	24–29	3–3	10–3	2–8	4–0
9	8	10	8	300	215	35–60	24–30	3–3	10–5	2–8	4–0
9	8	12	8	300	311	25–30	26–31	3–3	10–3	2–8	4–0
9	8	14	8	300	424	10–20	22–31	3–3	10–5	2–8	4–0
12	10	10	10	275	245	80–125	39–46	4–0	12–0	3–2	4–8
12	10	12	10	275	355	60–100	51–62	4–0	11–10	3–2	4–8
12	10	14	10	275	484	30–55	45–63	4–0	12–0	3–2	4–8
12	10	17	10	275	718	10–25	42–63	4–0	12–0	3–2	4–8
14	12	12	12	250	386	80–125	61–70	5–0	13–8	4–1	5–9
14	12	14	12	250	528	45–100	66–88	5–0	13–9	4–1	5–9
14	12	17	12	250	781	25–40	75–93	5–0	13–10	4–1	5–9
14	12	20	12	250	1086	10–20	72–95	5–0	14–2	4–1	5–9

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Class "FR-2" Steam Driven High Pressure Compressors

Steam Pressures
10 to 175 Pounds

Discharge Pressures
150 to 250 Pounds



These compressors have been specially designed for high pressure service when handling air or gas, or in the extraction of gasoline from natural and casing-head gases.

The frames, running parts, and steam cylinder are the same as those furnished with our "FR-1" Compressors described on page 8. Steam and compressor cylinders are lubricated by means of a force-feed lubricator. The compressor cylinders are two-stage, double-acting, arranged in tandem. The inlet and discharge valves are of the Ingersoll-Rand plate type.

A simple, efficient coil intercooler is mounted on the distance piece separating the compressor cylinders. No intercooler is furnished for gasoline extraction service.

These compressors can be furnished with either automatic cut-off flywheel governor or adjustable speed throttle governor. Suitable steam and compressor cylinder regulators are supplied when desired.

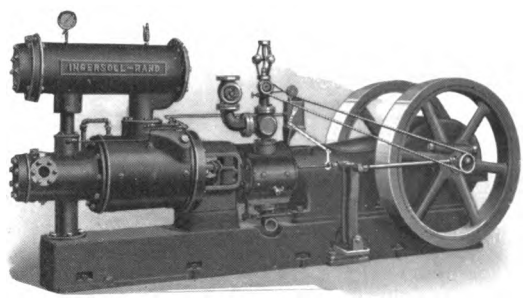
Full information on request.

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Class "NNF-2S" Steam Driven Compressors

Steam Pressures
80 to 175 Pounds

Discharge Pressures
150 to 500 Pounds



These two-stage, single-acting, straight-line compressors for air pressures up to 500 lbs. have main frames, running parts and piston valve steam cylinders similar to Class "FR" units (page 8). Steam and both air cylinders are lubricated by force-feed lubricators. The smaller size units have jacket type intercooler, "Direct Lift" poppet air inlet valves, and "Cushioned Direct Lift" poppet discharge valves. Larger units have overhead intercooler, mounted above the low and high pressure air cylinders, "Hurricane-Inlet" valves and "Cushioned Direct Lift" poppet discharge valves.

These compressors can be furnished with an automatic cut-off flywheel governor or adjustable speed throttling governor. Suitable air and steam regulation supplied if desired.

Full information on request.

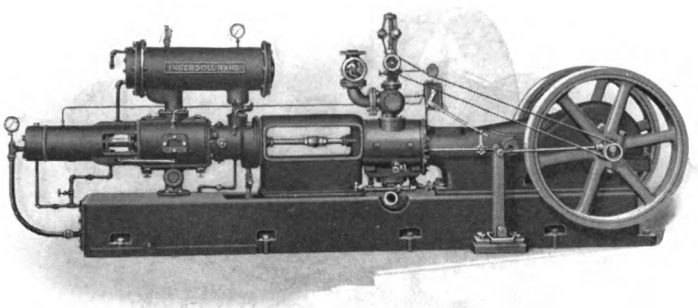
Piston Displacement Cu. Ft. Free Air per Min.	Discharge Pressure lbs. per sq. in.	Floor Space—Feet and Inches		
		Length	Width	Height
37	150–200	9–3	2–0	4–7
83	150–200	11–8	2–5	4–10
165	150–200	12–4	3–0	5–4
284	150–200	14–9	3–9	6–0
31	200–300	9–3	2–0	4–7
67	200–300	11–8	2–5	4–10
129	200–300	12–4	3–0	5–4
217	200–300	14–9	3–9	6–0
26	350–500	9–3	2–0	4–7
60	350–500	11–8	2–5	4–10
118	350–500	12–4	3–0	5–4
187	350–500	14–9	3–9	6–0

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Class "NNF-3" High Pressure Compressors

Steam Pressures
80 to 175 Pounds

Discharge Pressures
1000 to 2500 Pounds



Class "NNF-3" Compressors have the same type frame, running parts and piston valve steam cylinder as used on the Class "FR" compressors previously described. The compressor cylinders are of the three-stage type and designed for discharge pressures ranging from 1000 to 2500 pounds. The low pressure cylinder is double-acting and the intermediate and high pressure cylinders single-acting. Steam and compressor cylinders are oiled by force-feed lubricators. An overhead intercooler is located between the low and intermediate air cylinders. Between the intermediate and high pressure cylinders a coil type intercooler is used, the cooler being located in the subbase.

All compressor inlet valves are of the "Direct Lift" poppet type and discharge valves of the "Cushioned Direct Lift" poppet type.

These compressors can be furnished with either automatic cut-off flywheel governor or with adjustable speed throttle type.

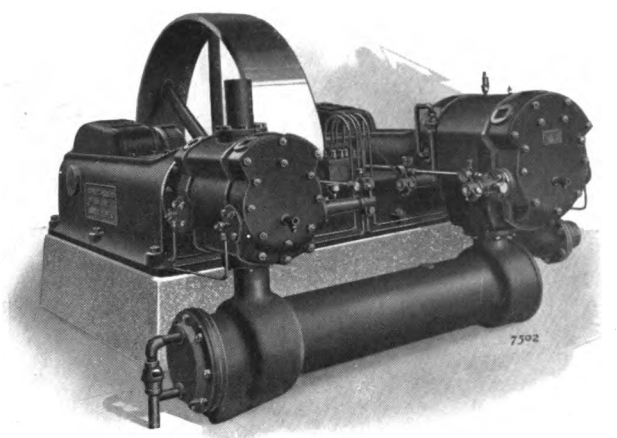
Special regulators supplied when required.

Full information on request.

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"Imperial" Type XB-2 Air Compressors Power Driven

Discharge Pressures 80 to 110 Pounds



"Imperial" Type XB-2 Compressors are of the cross-compound, two-stage construction having a belt wheel mounted on the compressor shaft. The frame construction is entirely enclosed and dust proof, removable covers affording ready inspection of all running parts.

Air cylinders are fitted with "Imperial Corliss" inlet valves and "Imperial Direct Lift" discharge valves. Each machine is fitted with an efficient intercooler having a removable nest of water tubes around which is circulated the air discharged from the low pressure cylinder. Correctly arranged baffles insure efficient heat transfer without undue pressure loss. For all sizes up to and including the 888 cu. ft. size compressors, underslung intercoolers are standard, while on the larger sized compressors the intercooler is mounted crosswise above the air cylinders.

The main bearings and running parts are lubricated by means of an automatic flood system, the oil being dipped from basins cast in the main frame and distributed to the parts to be lubricated. Both air cylinders are oiled by means of a force-feed lubricator.

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"Imperial" Type XB-2 Compressors
(Continued)

This type of compressor may be fitted with "Imperial" intake unloader or with both "Imperial" intake and discharge line unloaders. The "Imperial" short belt drive attachment can be furnished where the compressor is driven by standard electric motor.

Piston Displacement Cu. Ft. Free Air per Minute	B. H. P. Required at Belt Wheel of Compressor — Air Pressure		Overall Dimensions—Feet and Inches	
	80	110	Length	Width
For Sea Level				
203	32	36	7–8	5–3
327	50	57	8–4	5–7
446	68	76	9–9	6–1
599	92	104	11–0	7–8
888	135	152	12–6	8–9
1190	183	206	13–0	9–2
1482	226	254	15–1	9–11
5,000 Feet Altitude				
246	35	39	7–8	5–3
385	54	60	8–5	5–8
513	71	79	9–9	6–4
677	94	105	11–0	7–11
984	136	151	12–7	8–10
1302	179	200	13–0	9–2
1616	222	248	15–1	9–11
10,000 Feet Altitude				
293	38	42	7–10	5–4
447	57	63	8–7	5–9
584	73	81	9–11	6–5
759	96	107	11–1	7–11
1085	136	150	12–8	8–11
1418	177	197	13–1	9–4
1754	220	243	15–2	10–1

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"Imperial" Type XB-1 Air Compressors Power Driven

Discharge Pressures 15 to 100 Pounds

"Imperial" Type XB-1 Compressors have duplex, single-stage air cylinders, and are built for air discharge pressures up to 100 pounds. The frame construction, cylinders and valves, bearings and lubrication are identical with those found in "Imperial" Type XB-2 Compressors, described in the preceding pages. Being single-stage units, "Imperial" Type XB-1 Compressors are not furnished with intercoolers.

These compressors can be provided with "Imperial" unloaders, and also with short belt drive attachment.

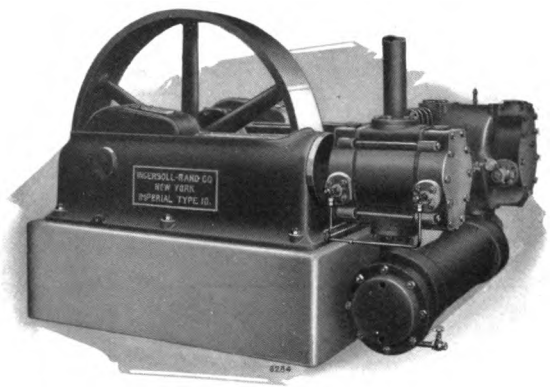
Bulletin 3312.

Piston Displ. Cu. Ft. Free Air per Min.	Air Pressure Designed for		Brake H. P. Required at Belt Wheel of Compressor		Overall Dimensions Feet and Inches	
	Min.	Max.	Min.	Max.	Length	Width
198	60	100	27	37	7-6	5-0
258	40	55	29	35	7-6	5-0
327	27	35	27	34	7-8	5-1
405	22	25	29	33	7-8	5-1
491	15	20	28	35	7-8	5-1
289	75	100	47	55	8-2	5-3
367	55	70	50	58	8-2	5-3
454	40	50	51	58	8-4	5-5
549	27	35	46	57	8-4	5-5
655	22	25	47	54	8-4	5-5
770	15	20	44	55	8-5	5-7
365	85	100	62	69	9-7	5-10
453	60	80	64	75	9-7	5-10
549	47	55	66	74	9-7	5-10
654	37	45	67	78	9-9	6-0
769	25	35	63	80	9-9	6-0
1025	15	20	58	72	9-9	6-1
563	80	100	94	106	10-10	7-4
671	60	75	95	108	10-10	7-4
789	45	55	94	106	11-0	7-6
916	35	40	93	102	11-0	7-6
1198	25	30	99	112	11-0	7-6
1518	15	20	87	108	11-1	7-10
826	80	100	135	154	12-4	8-2
959	65	75	142	155	12-4	8-2
1103	45	60	129	155	12-4	8-2
1419	30	40	129	158	12-6	8-4
1775	20	25	123	145	12-6	8-4
2171	15	20	126	157	12-8	8-8
1100	80	100	181	206	12-10	8-2
1253	55	75	188	202	12-10	8-2
1592	35	50	161	205	13-0	8-4
2168	25	30	177	202	13-0	8-6
2836	15	20	162	202	13-1	8-10
1254	75	100	197	232	14-11	9-0
1615	50	70	204	251	14-11	9-0
2020	35	45	214	242	15-1	9-4
2714	25	30	223	255	15-1	9-4
3508	15	20	203	253	15-2	9-8

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"Imperial" Type XB-2 High Pressure Compressors Power Driven

Discharge Pressures 125 to 500 Pounds



"Imperial" Type XB-2 High Pressure Compressors are of the same general construction as the "Imperial" Type XB-2 Compressors described on pages 12 and 13. The air cylinders and other parts of the compressor have been especially designed to take care of high discharge pressures.

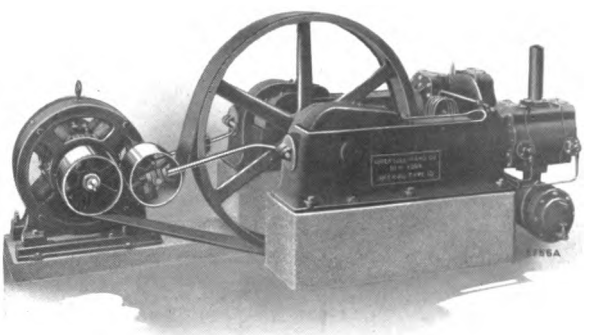
These compressors can be furnished with "Imperial" inlet or "Imperial" inlet and discharge line unloaders and with short belt drive attachment.

Full information on request.

Piston Displ. Cu. Ft. per Min.	Air Pressure		Brake H. P. Required at Belt Wheel of Compressor		Overall Dimensions Feet and Inches	
	Min.	Max. Allowable	Min.	Max.	Length	Width
205	350	500	57	65	9–7	5–11
248	260	350	62	70	9–7	5–11
272	210	260	64	70	9–7	5–11
296	170	210	63	68	9–9	6–1
321	125	170	60	69	9–9	6–1
308	350	500	87	98	10–10	7–6
335	275	350	86	94	10–10	7–6
362	225	275	87	95	10–10	7–6
391	175	225	85	94	11–0	7–8
421	125	175	78	92	11–0	7–8
324	340	500	116	133	12–4	8–7
487	275	340	125	135	12–4	8–7
521	225	275	124	135	12–4	8–7
554	175	225	120	134	12–6	8–9
626	125	175	115	136	12–6	8–9
553	350	500	154	175	12–10	9–2
625	275	350	160	176	12–10	9–2
702	200	275	159	182	12–10	9–2
782	160	200	163	179	13–0	9–2
867	125	160	159	180	13–0	9–2
781	350	500	217	246	14–11	9–11
877	260	350	219	246	14–11	9–11
978	200	260	222	246	14–11	9–11
1084	160	200	226	249	15–1	9–11
1196	125	160	220	249	15–1	9–11

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"Imperial" Type XB Compressors
Short Belt Electric Driven



Any of the "Imperial" XB-1 and XB-2 Compressors described on pages 12 to 15 can be furnished with electric motor and short belt drive attachment. The equipment includes the compressor, belt, and the motor with starter base and pulley.

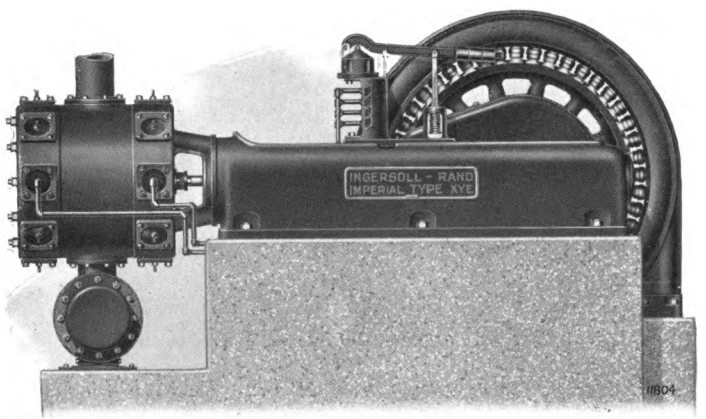
This short belt drive attachment consists of an idler pulley and supporting arms attached to the ends of the main frame. The idler pulley floats freely on the belt thereby causing no initial tension except its own weight. This arrangement affords a material saving of floor space and better belt contact with less belting.

Bulletin 3312.

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"Imperial" Type XYE Compressors Direct-Connected Electric Motor Driven

Discharge Pressures 20 to 100 pounds



"Imperial" Type XYE Compressors are of duplex, two-stage construction having the rotor of the electric motor direct-connected to the compressor shaft.

Air cylinders are fitted with Ingersoll-Rand plate valves for both intake and discharge. These valves are light-weight, noiseless, and have liberal port areas. The development of this type of plate valve is largely responsible for the success of the direct-connected motor driven compressor.

An efficient intercooler is located crosswise underneath the low and high pressure air cylinders. This cooler is fitted with a removable nest of water tubes around which is circulated the air discharged from the low pressure cylinder. Correctly arranged baffles insure efficient heat transfer without undue pressure loss.

The main bearings and running parts are lubricated by means of an automatic flood system, the oil being dipped from basins cast in the main frames and distributed to the parts to be lubricated. Both air cylinders are oiled by means of a force-feed lubricator.

A compressor having its shaft direct-connected to the motor is necessarily a constant speed unit; efficient regulation permitting the motor to assume the

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"Imperial" Type XYE Compressors

(Continued)

load or unload in gradual steps is essential in order to insure satisfactory motor operation. The regulation of "Imperial XYE" Compressors is automatically accomplished by the patented 5-step Clearance Control which loads or unloads the compressor in five successive steps, viz., full load, ¾, ½, ¼ and no load. With the Clearance Control a number of clearance pockets in both high and low pressure cylinders are thrown in communication with each cylinder in proper succession, the process being controlled by a predetermined air receiver pressure. The proper cylinder ratio is automatically maintained and consequently the highest compression efficiency is obtained at all loads. The reduction in power secured with this method of control is in proportion to the reduction in load.

Where alternating current conditions prevail the most acceptable direct-connected motor drive is the self-starting synchronous type. The Company will quote on the compressor outfit, viz., compressor, motor, exciter and starting panel.

These compressors are also built in single-stage construction for low air discharge pressures.

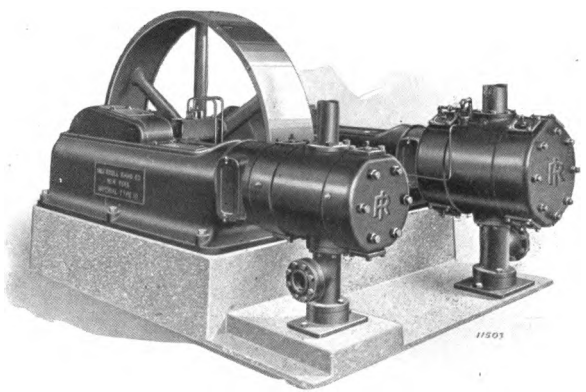
Full information on request.

Piston Displacement	B. H. P.		Floor Space Feet and Inches	
	100 lbs. Air	110 lbs. Air	Length	Width
627	106	109	10-0	10-3
940	155	161	11-0	12-0

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"Imperial" Type XYB-2 Compressors For Gasoline Extraction Power Driven

Discharge Pressures 125 to 300 Pounds



"Imperial" Type XYB-2 Compressors have been designed to meet the demands involved in the extraction of gasoline from casing head and natural gases.

These compressors are of two-stage cross-compound construction. The frame construction is entirely enclosed and dust-proof, removable covers affording easy inspection of all running parts.

The compressor cylinders are fitted with Ingersoll-Rand plate inlet and discharge valves, the discharge valves being placed at the bottom of the cylinders to permit escape of extracted gasoline. The cylinders are completely water-jacketed. Double stuffing boxes are provided, one being located in the cylinder head adjoining the main frame, and the other in an auxiliary stuffer plate. This arrangement prevents the gasoline from leaking back into the crank-case and destroying the lubricating properties of the crank-case oil.

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"Imperial" Type XYB-2 Compressors For Gasoline Extraction

(Continued)

The main bearings and running parts are lubricated by means of an automatic flood system, the oil being dipped from basins cast in the main frame and distributed to the parts to be lubricated. Both compressor cylinders are lubricated by means of force-feed lubricator.

If desired, these compressors can be fitted with standard short belt drive attachment.

Bulletin 3218.

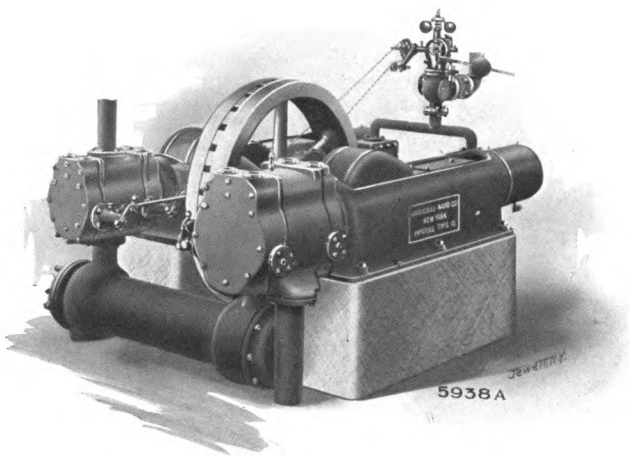
Piston Displacement Cu. Ft. per Min.	Discharge Pressure Gage, Lbs. per Sq. In.		B. H. P. Required at Belt Wheel of Compressor at Pressure Given		Floor Space Feet and Inches	
	Min.	Max.	Min.	Max.	Length	Width
120			28	31	8-5	5-1
129	225	300	30	33	8-5	5-1
136			32	35	8-5	5-1
150			29	35	8-6	5-2
162	125	200	31	38	8-6	5-2
170			33	40	8-6	5-2
208			48	54	9-4	5-6
226	225	300	52	59	9-4	5-6
238			55	62	9-4	5-6
250			48	58	9-6	5-7
272	125	200	52	63	9-6	5-7
286			55	68	9-6	5-7
273			63	71	10-6	6-1
296	225	300	68	77	10-6	6-1
312			72	81	10-6	6-1
320			61	74	10-8	6-2
348	125	200	67	81	10-8	6-2
366			70	85	10-8	6-2
396			91	103	12-0	7-5
432	225	300	100	112	12-0	7-5
458			106	119	12-0	7-5
455			88	106	12-3	7-7
498	125	200	96	116	12-3	7-7
526			101	122	12-3	7-7
553			128	143	13-5	8-5
608	225	300	140	157	13-5	8-5
646			150	168	13-5	8-5
625			120	145	13-9	8-7
688	125	200	132	160	13-9	8-7
730			140	170	13-9	8-7

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"Imperial" Type X-2 and X-3 Compressors Steam Driven

Steam Pressures
80 to 150 Pounds

Discharge Pressures
80 to 110 Pounds



"Imperial" Type X-2 and X-3 Compressors are of the duplex, two-stage construction. The main frames are enclosed and entirely dust-proof, removable covers affording ready inspection of all moving parts.

The air cylinders are fitted with "Imperial Corliss" inlet valves, and "Imperial Direct Lift" poppet discharge valves. Smaller machines are equipped with steam valves having a fixed cut-off, while on the larger compressors Meyer adjustable cut-off type are furnished.

Each compressor is fitted with an efficient intercooler having a removable nest of water tubes around which is circulated the air discharged from the low pressure air cylinder. For all sizes up to and including the 888 cu. ft. per minute machine, underslung intercoolers are standard, while on larger size compressors intercoolers are mounted crosswise above the air cylinders.

The main bearings and running parts are lubricated by means of an auto-

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"Imperial" Type X-2 and X-3 Compressors

(Continued)

matic flood system, the oil being dipped from basins cast in the main frames. Both air and steam cylinders are lubricated by force-feed lubricators.

Regulation is accomplished by either an Air Ball Speed and Pressure Governor or a plain adjustable speed type, depending upon the service for which the compressor is intended.

"Imperial" Type X-2 Compressors have simple, duplex steam cylinders and compound duplex air cylinders.

"Imperial" Type X-3 Compressors have compound, duplex steam cylinders and compound, duplex air cylinders.

Bulletin 3311.

Piston Displacement Cu. Ft. Free Air per Minute	Air Pressures		Overall Dimensions—Feet and Inches	
	Min.	Max.	Length	Width
For Sea Level				
203	80	100	8–8	5–1
327	80	100	9–5	5–5
446	80	100	10–5	6–0
599	80	100	11–9	7–8
888	80	100	13–5	8–9
1190	80	100	13–10	9–2
1436	80	100	15–9	9–6
5,000 Feet Altitude				
246	80	100	8–8	5–1
385	80	100	9–6	5–6
513	80	100	10–6	6–1
677	80	100	11–10	7–9
984	80	100	13–6	8–10
1302	80	100	13–10	9–2
1564	80	100	15–9	9–6
10,000 Feet Altitude				
293	80	100	8–10	5–2
447	80	100	9–8	5–7
584	80	100	10–8	6–2
759	80	100	11–11	7–11
1085	80	100	13–7	8–11
1418	80	100	13–11	9–4
1698	80	100	15–10	9–8

Note:—Compound steam cylinders can be furnished for conditions where desirable, usually for steam pressures of 100 lbs. or higher.

Extra large simple, duplex steam cylinders can be furnished for steam pressures less than 80 lbs.

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"Imperial" Type X-1 and X-4 Compressors Steam Driven

Steam Pressures
80 to 150 Pounds

Discharge Pressures
15 to 100 Pounds

"Imperial" Type X-1 and X-4 Compressors are of the duplex, single-stage construction for low air discharge pressures. The frame construction, main bearings, lubrication and methods of governing are the same as are found in Type X-2 and X-3 Compressors described in preceding pages. Being single-stage units, no intercoolers are furnished.

"Imperial" Type X-1 Compressors have simple, duplex steam cylinders and simple, duplex air cylinders.

"Imperial" Type X-4 Compressors have compound, duplex steam cylinders and simple, duplex air cylinders. Bulletin 3311.

Piston Displacement Cu. Ft. Free Air Per Minute	Air Pressure Designed For		Floor Space—Feet and Inches	
	Min.	Max.	Length	Width
198	60	100	8–6	5–0
258	40	55	8–6	5–0
327	27	35	8–8	5–1
405	22	25	8–8	5–1
491	15	20	8–8	5–1
289	75	100	9–3	5–3
367	55	70	9–3	5–3
454	40	50	9–5	5–5
549	27	35	9–5	5–5
655	22	25	9–5	5–5
770	15	20	9–6	5–7
365	85	100	10–3	5–10
453	60	80	10–3	5–10
549	47	55	10–3	5–10
654	37	45	10–5	6–0
769	25	35	10–5	6–0
1025	15	20	10–6	6–1
563	80	100	11–7	7–4
671	60	75	11–7	7–4
789	45	55	11–9	7–6
916	35	40	11–9	7–6
1198	25	30	11–9	7–6
1518	15	20	11–11	7–10
826	80	100	13–3	8–2
959	65	75	13–3	8–2
1103	45	60	13–3	8–2
1419	30	40	13–5	8–4
1775	20	25	13–5	8–4
2171	15	20	13–7	8–8
1100	80	100	13–8	8–2
1253	55	75	13–8	8–2
1592	35	50	13–10	8–4
2168	25	30	13–10	8–6
2836	15	20	13–11	8–10
1213	75	100	15–7	8–5
1562	50	70	15–7	8–5
1955	35	45	15–9	8–8
2626	25	30	15–9	8–8
3395	15	20	15–10	9–4

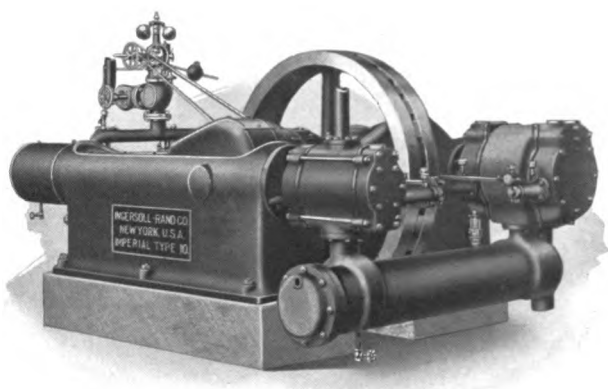
Note:—Compound steam cylinders can be furnished for conditions where desirable, usually for steam pressures of 100 lbs. or higher.
Extra large simple, duplex steam cylinders can be furnished for steam pressures less than 80 lbs.

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"Imperial" Type X-2 and X-3 High Pressure Compressors Steam Driven

Steam Pressures
80 to 150 Pounds

Discharge Pressures
125 to 500 Pounds



"Imperial" Type X-2 and X-3 Compressors are of the duplex, two-stage construction. The main frames are enclosed and entirely dust-proof, removable covers affording ready inspection of all moving parts.

The air cylinders are especially constructed to operate with high air discharge pressures, and are fitted with "Imperial Corliss" inlet valves, and "Imperial Direct Lift" poppet discharge valves. Smaller machines are equipped with steam valves having a fixed cut-off, while on the larger compressors Meyer adjustable cut-off type are furnished.

Each compressor is fitted with an efficient intercooler having a removable nest of water tubes around which is circulated the air discharged from the low pressure cylinder. For all sizes up to and including the 423 cu. ft. per minute machine, underslung intercoolers are standard, while in larger size compressors intercoolers are mounted crosswise above the air cylinders.

The main bearings and running parts are lubricated by means of an auto-

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"Imperial" Type X-2 and X-3 High Pressure Compressors

(Continued)

matic flood system, the oil being dipped from basins cast in the main frames. Both air and steam cylinders are lubricated by force-feed lubricators.

Regulation is accomplished by either an Air Ball Speed and Pressure Governor or a plain adjustable speed type, depending upon the service for which the compressor is intended.

"Imperial" Type X-2 Compressors have simple duplex steam cylinders and compound duplex air cylinders.

"Imperial" Type X-3 Compressors have compound, duplex steam cylinders and compound, duplex air cylinders.

Bulletin 3311.

Piston Displ. Cu. Ft. per Min.	Air Pressure		Overall Dimensions—Ft. & Ins.	
	Min.	Max.	Length	Width
205	350	500	10–3	5–10
248	260	350	10–3	5–10
272	210	260	10–3	5–10
296	170	210	10–5	6–0
321	125	170	10–5	6–0
308	350	500	11–7	7–6
335	275	350	11–7	7–6
362	225	275	11–7	7–6
391	175	225	11–9	7–8
421	125	175	11–9	7–8
423	340	500	13–3	8–7
487	275	340	13–3	8–7
521	225	275	13–3	8–7
554	175	225	13–5	8–9
626	125	175	13–5	8–9
553	350	500	13–8	9–2
625	275	350	13–8	9–2
702	200	275	13–8	9–2
782	160	200	13–10	9–2
867	125	160	13–10	9–2
781	350	500	15–7	9–6
877	260	350	15–7	9–6
978	200	260	15–7	9–6
1084	160	200	15.9	9–6
1196	125	160	15–9	9–6

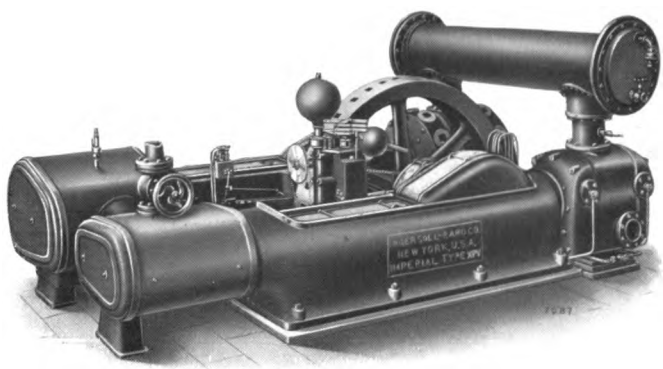
Note:—Compound steam cylinders can be furnished where desirable, usually for steam pressure of 100 lbs or higher.
Extra large simple, duplex steam cylinders can be furnished for steam pressures less than 80 lbs.

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"Imperial" Type XPV-2 and XPV-3 Compressors, Steam Driven

Steam Pressures
80 to 180 Pounds

Discharge Pressures
80 to 110 Pounds



The "Imperial" Type XPV Compressors have been designed and constructed to operate satisfactorily under high steam pressures and superheat as well as on saturated steam conditions. The steam cylinders are fitted with "Imperial" balanced piston steam valves of the telescopic type; and the combination of these steam valves and the automatic cut-off governor result in remarkable steam economies.

"Imperial" Type XPV-2 and XPV-3 Compressors are of the duplex, two-stage construction. The main frames are enclosed and entirely dust-proof. The air cylinders are fitted with "Imperial Corliss" inlet valves and "Imperial Direct Lift" poppet discharge valves.

Each compressor is fitted with an efficient intercooler having a removable nest of water tubes around which is circulated the air discharged from the low pressure cylinder. In the smaller sizes this intercooler is located crosswise underneath the air cylinders, while on the larger sizes it is mounted above the two air cylinders.

The main bearings and running parts are lubricated by means of an auto-

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"Imperial" Type XPV-2 and XPV-3 Compressors, Steam Driven

(Continued)

matic flood system, the oil being dipped from basins cast in the main frame. Both air and steam cylinders are oiled by force-feed lubricators.

All XPV Compressors are fitted with the "Imperial" automatic cut-off governor which regulates the position of the high pressure cut-off in accordance with the demand for air. This governor can be furnished as a speed and pressure governor or a plain adjustable speed type.

"Imperial" Type XPV-2 Compressors have simple, duplex steam cylinders and compound, duplex air cylinders.

"Imperial" Type XPV-3 Compressors have compound, duplex steam cylinders and compound, duplex air cylinders.

Bulletin 3033.

Piston Displacement Cu. Ft. Free Air per Minute	Air Pressures Designed for—Pounds		Overall Dimensions—Feet and Inches	
	Min.	Max.	Length	Width
Sea Level				
648	80	110	12–0	7–8
940	80	110	13–6	8–9
1260	80	110	14–0	9–2
1531	80	110	17–4	10–3
1955	80	110	17–10	11–0
5,000 Ft. Altitude				
731	80	110	12–2	7–9
1042	80	110	13–8	8–10
1378	80	110	14–2	9–3
1668	80	110	17–6	10–4
2109	80	110	18–0	11–1
10,000 Ft. Altitude				
820	80	110	12–3	7–10
1150	80	110	13–9	8–11
1501	80	110	14–3	9–4
1810	80	110	17–7	10–5
2268	80	110	18–2	11–2

Note:—Compound steam cylinders can be furnished for conditions where desired, usually for steam pressures of 100 lbs. or higher.

Extra large single, duplex steam cylinders can be furnished for steam pressures less than 80 lbs.

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"Imperial" Type XPV-1 and XPV-4 Compressors, Steam Driven

Steam Pressures
80 to 180 Pounds

Discharge Pressures
15 to 100 Pounds

"Imperial" Type XPV-1 and XPV-4 Compressors are of the duplex single-stage construction for low air discharge pressures. The frame construction, main bearings, lubrication and methods of governing are the same as are used in Type XPV-2 and XPV-3 Compressors described in the preceding pages. Being single stage units no intercoolers are furnished.

"Imperial" Type XPV-1 Compressors have simple, duplex steam cylinders and simple duplex air cylinders.

"Imperial" Type XPV-4 Compressors have compound, duplex steam cylinders and simple, duplex air cylinders.

Bulletin 3033.

Piston Displacement in Cu. Ft. of Free Air per Minute	Air Pressure Designed For	Overall Dimensions—Feet and Inches	
		Length	Width
608	80–100	11–8	7–4
725	60– 75	11–8	7–4
952	45– 55	11–10	7–6
990	35– 40	11–10	7–6
1295	25– 30	12–0	7–8
1640	15– 20	12–3	7–10
876	80–100	13–2	8–6
1016	65– 75	13–2	8–6
1166	45– 60	13–4	8–7
1504	30– 40	13–4	8–7
1880	20– 25	13–6	8–9
2300	15– 20	13–9	8–11
1164	80–100	13–8	8–8
1326	55– 75	13–9	8–10
1686	35– 50	13–10	9–0
2296	25– 30	14–0	9–2
3002	15– 20	14–3	9–4
1294	75–100	17–0	10–0
1666	50– 70	17–2	10–2
2086	35– 45	17–2	10–2
2800	25– 30	17–4	10–3
3620	15– 20	17–6	10–6
1463	85–100	17–4	10–4
1864	60– 80	17–6	10–6
2304	45– 55	17–8	10–8
2798	35– 40	17–8	10–8
3616	25– 30	17–10	11–0
4219	15– 20	18–0	11–2

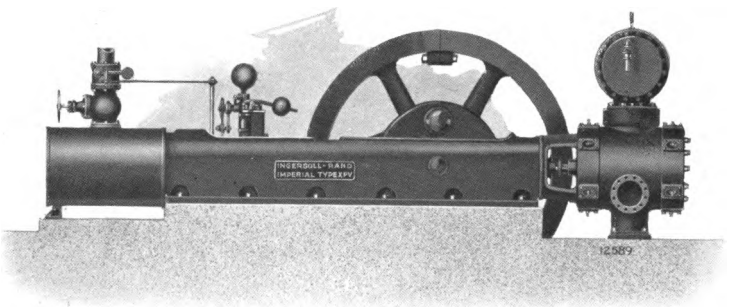
Note:—Compound steam cylinders can be furnished for conditions where desired, usually for steam pressures of 100 lbs. or higher.
Extra large single duplex steam cylinders can be furnished for steam pressures less than 80 lbs.

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"Imperial" Type XPV Compressors
Steam Driven
24" AND 30" STROKE MACHINES

Steam Pressures
80 to 180 Pounds

Discharge Pressures
15 to 110 Pounds



The "Imperial" Type XPV Compressors described on the preceding pages can now be furnished in the 24 inch and 30 inch stroke sizes. These compressors have the same steam and air cylinder combinations as have been described for the "Imperial" XPV-1, XPV-2, XPV-3 and XPV-4 Compressors.

The 24 inch and 30 inch stroke machines are similar to the smaller units with the exception that the cylinders are furnished with Ingersoll-Rand plate inlet and discharge valves.

All compressors of these two strokes have intercoolers of the overhead type.

Full information on request.

Piston Displacement Cu. Ft. Free Air per Minute	Air Pressures Designed For—Pounds		Overall Dimensions—Feet and Inches	
	Min.	Max.	Length	Width
Sea Level				
3030	80	110	22-3	13-6
4145	80	110	27-7	17-3
5,000 Ft. Altitude				
3445	80	110	22-5	13-8
4630	80	110	27-10	17-6
10,000 Ft. Altitude				
3890	80	110	22-8	13-10
5155	80	110	28-0	17-9

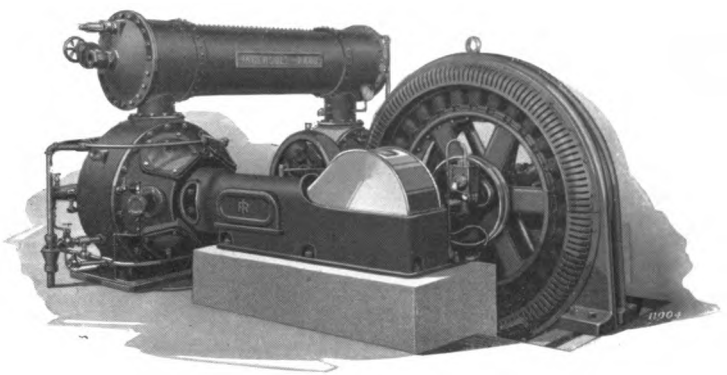
For table of Duplex, single-stage air cylinders refer to Company's New York Office.

Note:—Compound steam cylinders can be furnished for conditions where desired, usually for steam pressures of 100 lbs. or higher.
Extra large single Duplex steam cylinders can be furnished for steam pressures less than 80 lbs.

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Class "PRE-2" Air Compressors
Direct-Connected Electric Motor Drive

Discharge Pressures 60 to 115 Pounds



Class "PRE-2" Compressors are of the duplex, two-stage construction having the rotor of the electric motor direct-connected to the compressor shaft. The heavy tangye frame construction is entirely enclosed and dust-proof, removable covers affording ready inspection of all running parts.

Air cylinders are fitted with Ingersoll-Rand plate valves for both intake and discharge. These valves are light-weight, noiseless, and have liberal port areas. The development of this type of plate valve is largely responsible for the success of the direct-connected motor driven compressor.

An efficient intercooler is mounted crosswise on the low and high pressure air cylinders. This cooler is fitted with a removable nest of water tubes around which is circulated the air discharged from the low pressure cylinder. Correctly arranged baffles insure efficient heat transfer without undue pressure loss.

The main bearings and running parts are lubricated by means of an automatic flood system, the oil being dipped from basins cast in the main frame and distributed to the parts to be lubricated. Both air cylinders are oiled by means of a force-feed lubricator.

A compressor having its shaft direct-connected to the motor is necessarily a constant speed unit. Efficient regulation, permitting the motor to assume the load or unload in gradual steps, is essential in order to insure satisfactory motor operation. The regulation of Class "PRE" Compressors is automatically accomplished by the patented 5-step Clearance Control which loads or unloads the compressor in five successive steps, viz., full load, ¾, ½, ¼ and no load.

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Class "PRE-2" Air Compressors

(Continued)

With the Clearance Control a number of clearance pockets in both high and low pressure cylinders are thrown in communication with each cylinder in proper succession, the process being controlled by a predetermined air receiver pressure. The proper cylinder ratio is automatically maintained and consequently the highest compression efficiency is obtained at all loads. The reduction in power secured with this method of control is in proportion to the reduction in load.

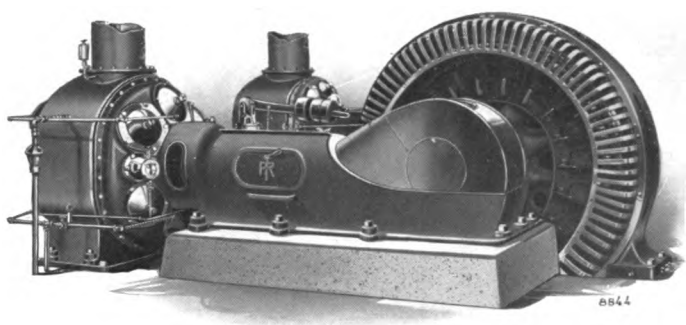
Where alternating current conditions prevail the most acceptable direct-connected motor drive is the self-starting synchronous type. The Company will quote on the complete outfit, viz., compressor, motor, exciter and starting panel. Bulletin 3126.

Capacity Cu. Ft. per Min. Piston Displacement	Motor B. H. P. at Pressures Given		Approximate Floor Space with Motor—Feet and Inches		
			Length	Width	Height
Medium Duty— Sea Level	Air Pressure 90 lbs.	100 lbs.			
1302	201	210	11–9	11–9	7–2
1574	251	264	14–3	12–6	7–3
2033	309	324	16–0	14–4	8–0
2874	455	478	18–0	16–0	10–6
3633	567	596	19–9	18–0	11–6
5011	752	787	25–0	19–0	12–3
5967	972	1020	29–3	20–0	12–9
7440	1120	1179	30–9	26–0	15–10
High Duty— Sea Level	Air Pressure 100 lbs.	115 lbs.			
1172	176	187	11–9	11–9	7–2
1433	228	242	14–3	12–6	7–3
1873	284	302	16–0	14–4	8–0
2678	431	458	18–0	16–0	10–6
3405	532	565	19–9	18–0	11–6
4482	671	713	25–0	19–0	12–3
5378	886	940	29–3	20–0	12–9
6770	1024	1084	30–9	26–0	15–10
Medium Duty— 5,000 Feet Altitude	Air Pressure 90 lbs.	100 lbs.			
1435	204	213	11–9	11–9	7–2
1721	248	260	14–3	12–6	7–3
2195	301	314	16–0	14–4	8–0
3078	439	458	18–0	16–0	10–6
4102	579	605	19–9	18–0	11–6
5576	763	796	25–0	19–0	12–3
6586	966	1010	29–3	20–0	12–9
8145	1112	1163	30–9	26–0	15–10
High Duty— 5,000 Feet Altitude	Air Pressure 100 lbs.	115 lbs.			
1302	178	188	11–9	11–9	7–2
1574	227	239	14–3	12–6	7–3
2033	278	293	16–0	14–4	8–0
2874	419	441	18–0	16–0	10–6
3864	545	575	19–9	18–0	11–6
5011	685	720	25–0	19–0	12–3
5967	882	930	29–3	20–0	12–9
7440	1010	1065	30–9	24–0	15–10

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Class "PRE-1" Air Compressors Direct-Connected Electric Motor Driven Units

For Low Discharge Pressures



Class "PRE-1" Compressors are of the duplex, single-stage construction having the rotor of the electric motor direct-connected to the compressor shaft. The frame construction, main bearings, and lubrication are identical with that found in Class "PRE-2" units described on the preceding pages.

The Class "PRE-1" Compressor being a single-stage unit, has two low pressure air cylinders. As these are single-stage units no intercooler is necessary.

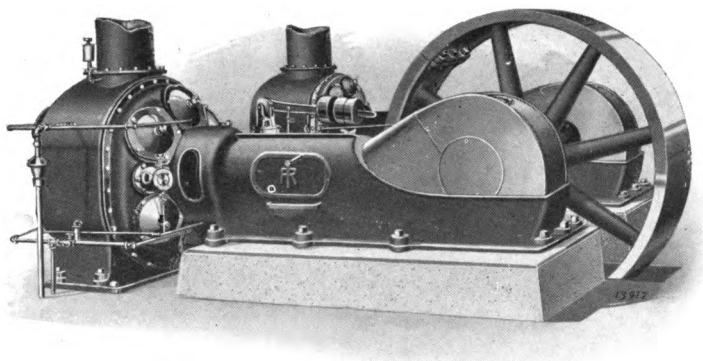
Regulation is secured by means of a patented 5-step Clearance Control similar to that furnished with the Class "PRE-2" Compressor. This control has been found to be the most satisfactory air compressor control for machines having their shafts direct-connected to electric motors.

The Company will be pleased to quote on units of this construction for different air pressures and capacities. Compressors of this type are furnished complete with electric motor, starting panel and, where alternating current is used, with exciter.

Bulletin 3126.

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Class "PRB-1" and "PRB-2" Compressors Power Driven

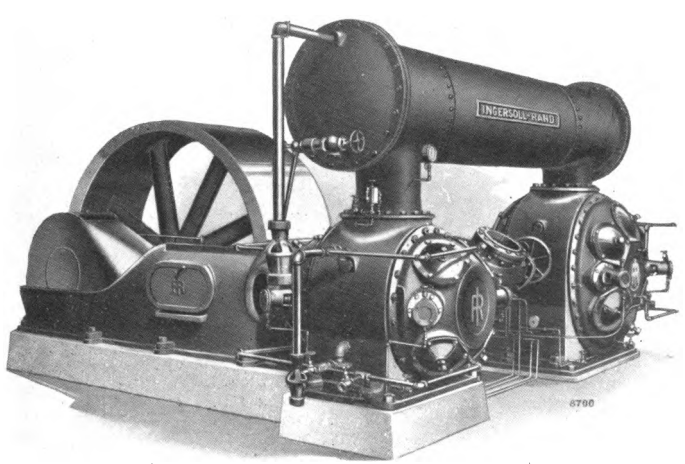


Class "PRB-1" Duplex, Single-stage Compressor

Class "PRB-1" and Class "PRB-2" Compressors are similar to the Class "PRE" Compressors described in pages 30-32, with the exception of the method of drive. Class "PRB" units are offered in several sizes, 14, 16, 18, 21 and 24 inch strokes. Compressors up to and including the 21 inch stroke are fitted with belt wheel for belt drive, and the 24 inch stroke is equipped with rope drive.

Details regarding capacities and pressures will be furnished on request.

Bulletin 3126.



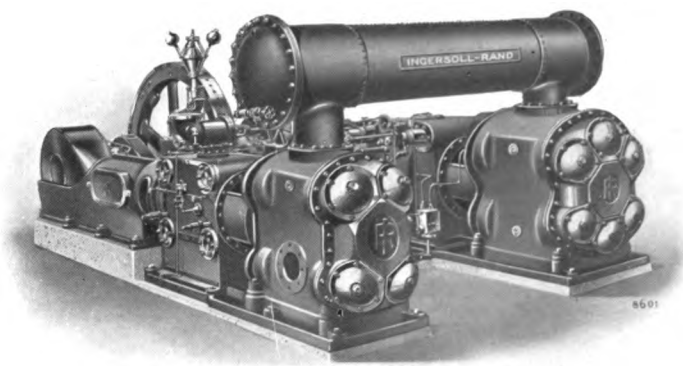
Class "PRB-2" Duplex, Two-stage Compressor

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Class "ORC-2" and "ORC-3" Compressors Steam Driven

Steam Pressures
90 to 180 Pounds

Discharge Pressures
90 to 125 Pounds



Class "ORC-2" and "ORC-3" Compressors are of the duplex, two-stage construction. The steam cylinders next to the frames are separated from the air cylinders by means of open distance pieces. The heavy tangye frame construction is entirely enclosed and dust-proof, removable covers affording ready inspection of all moving parts.

Air cylinders are fitted with Ingersoll-Rand plate valves for both intake and discharge. These valves are light-weight, noiseless, and have liberal port areas. The steam cylinders are equipped with a full Corliss valve gear with vacuum dashpots and double-ported steam inlet and exhaust valves. The steam cylinders are covered with non-conducting material and lagged.

An efficient intercooler is mounted crosswise on the low and high pressure air cylinders. This cooler is fitted with a removable nest of water tubes around which is circulated the air discharged from the low pressure cylinder. Correctly arranged baffles insure efficient heat transfer without undue pressure loss.

The main bearings and running parts of Class "ORC" Compressors are lubricated by means of an automatic flood system, the oil being dipped from basins cast in the main frame and distributed to the parts to be lubricated. Both air and steam cylinders are oiled by means of a force-feed lubricator.

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Class "ORC-2" and "ORC-3" Compressors Steam Driven

(Continued)

All sizes and types of Class "ORC" Compressors may be supplied with fly-ball speed governor driven from the main shaft and having pressure-regulating cylinder connected to the air receiver, or with a governor of the adjustable piston type without the pressure regulator.

Class "ORC-2" Compressors have single duplex steam cylinders and compound duplex air cylinders.

Class "ORC-3" Compressors have compound duplex steam cylinders and compound duplex air cylinders.

Bulletin 3129.

Piston Displacement Cu. Ft. per Minute	Floor Space—Feet and Inches			
	Length Close Coupled	Length with Piston Rod Coupling	Width	Height
Sea Level 90-100 lbs. Air Pressure				
2550	23-11	26-5	15-6	8-6
3242	26-5	28-11	17-0	9-3
4384	28-8	31-2	19-0	11-6
5715	33-1	36-5	19-0	12-5
7310	39-8	42-10	21-8	15-0
Sea Level 110-115 lbs. Air Pressure				
2376	23-11	26-5	15-6	8-6
2847	26-5	28-11	17-0	9-3
3906	28-8	31-2	19-0	11-6
5153	33-1	36-5	19-0	12-5
6650	39-8	42-10	21-8	15-0
5,000 Feet Altitude 90-100 lbs. Air Pressure				
2731	23-11	26-5	15-6	8-6
3663	26-5	28-11	17-0	9-3
4888	28-8	31-2	19-0	11-6
6305	33-1	36-5	19-0	12-5
8000	39-8	42-10	21-8	15-0

Note:—Compound steam cylinders can be furnished for conditions where desirable, usually for steam pressures of 100 pounds or higher.

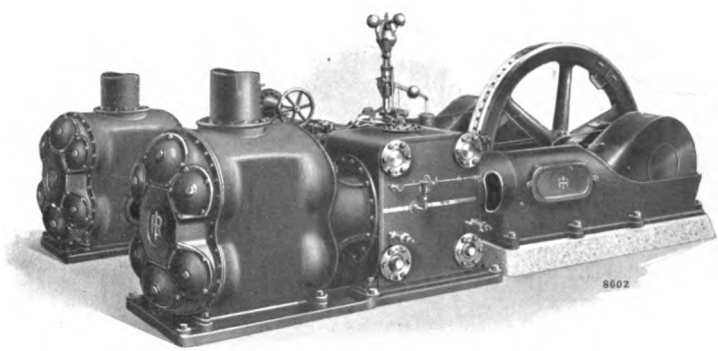
Extra large simple duplex steam cylinders can be furnished for steam pressures less than 90 lbs.

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Class "ORC-1" and "ORC-4" Compressors Steam Driven

Steam Pressures
90 to 180 Pounds

For Low
Discharge Pressures



Class "ORC-1" and "ORC-4" Compressors are of the duplex, single-stage construction for low discharge pressures. The frame construction, main bearings, lubrication and methods of governing are the same as are found in Class "ORC-2" and "ORC-3" Compressors described in the preceding pages. The steam cylinders of these compressors are equipped with full Corliss valve gear having vacuum dashpots and double-ported steam inlet and exhaust valves.

Class "ORC-1" Compressors have simple, duplex steam cylinders and simple, duplex air cylinders.

Class "ORC-4" Compressors have compound duplex steam cylinders and simple duplex air cylinders.

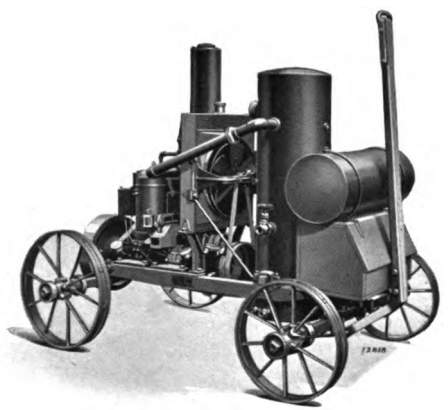
The Company will be pleased to quote on these compressors for various air pressures and capacities.

Bulletin 3129.

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"Imperial Type Fourteen" Portable Compressors, Gasoline Engine Driven

Discharge Pressures 90 to 100 Pounds



The smallest "Imperial" Portable Compressor unit consists of a single cylinder, two cycle gasoline engine, with a vertical, single cylinder air compressor. The outfit has a circulating water cooling system with radiator fan and pump. The running gear is of all steel construction. It has Ingersoll-Rand plate inlet and discharge valves, air receiver with safety valve and pressure gage. The entire equipment is mounted on a steel frame.

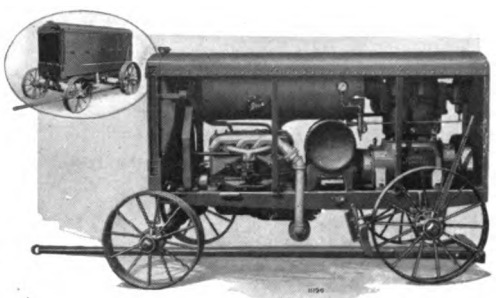
Bulletin 3215.

General Type		Cylinders, Inches				Style of Drive	Piston Displ. Cu. Ft. per Min.	Air Pressure	Gal. Gas Required per Hour	Overall Dimensions Ft. and Ins.			Weights		Diam. Wheels Inches		Tread—Ft. and Ins.
		Air Compr.		Gasoline Engine													
Compressor	Gasoline Engine	Bore	Stroke	Bore	Stroke					Length	Width	Height	Net	Boxed	Front	Rear	
Single Cyl.	Single Cyl. Two Cycle	5¾	5	5¾	5	Unit Crank Shaft	45	90	1½	6-5	4-6	4-8	1500	1900	20	24	3-6

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"Imperial Type Fourteen" Portable Compressors, Gasoline Engine Driven

Discharge Pressures 90 to 100 Pounds



The outfit consists of a two cylinder, vertical, duplex single-acting compressor, the 8x8 being connected by gear drive and clutch and the 6x6 direct coupled to four cylinder, four cycle, gasoline motor. The compressor is fitted with Ingersoll-Rand plate inlet and discharge valves, automatic splash lubrication, and "Imperial" intake unloader. The outfit has an efficient cooling system for both compressor and engine, with circulating water pump, radiator and fan. The entire equipment is mounted on a steel frame, liberally proportioned yet not unduly heavy. A light, steel canopy extends from top of radiator to rear of power plant to which is attached suitable coverings, this being waterproof black canvas side curtains for the 6 x 6 size and light steel doors for the 8 x 8 size.

The air receiver on the 6 x 6 outfit is mounted vertically in the extreme rear of the plant, whereas in the 8 x 8 size it is hung horizontally beneath the canopy and immediately above the compressor.

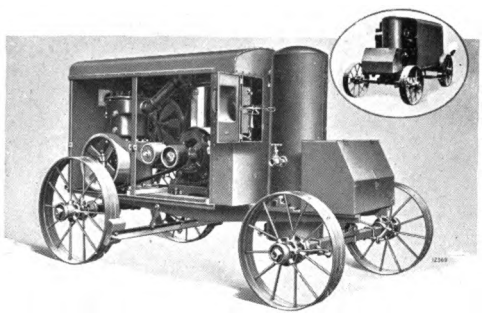
Bulletin 3215.

General Type		Cylinders, Inches				Style of Drive	Piston Displ. Cu. Ft. per Min.	Air Pressure	Gal. Gas Required per Hour	Overall Dimensions Ft. and Ins.			Weights		Diam. Wheels Inches		Tread—Ft. and Ins.
		Air Compr.		Gasoline Engine													
Compressor	Gasoline Engine	Bore	Stroke	Bore	Stroke					Length	Width	Height	Net	Boxed	Front	Rear	
Vertical Duplex	Four Cyl. Four Cycle	8	8	4¾	6¾	Geared	210	100	4	10–1	5–10	6-2	6000	6600	30	36	4–8
Vertical Duplex	Four Cyl. Four Cycle	6	6	4¾	6¾	Direct Couple	118	100	2½	9–6	5–10	5-9	4000	4500	30	30	4–8

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"Imperial Type Fourteen" Portable Compressors, Electric Motor Driven

Discharge Pressures 90 to 100 Pounds



The "Imperial Type Fourteen" Electric Driven Compressor is of the duplex vertical type. A standard electric motor drives the compressor by means of a short belt drive attachment. It has an automatic splash lubrication system, "Imperial" intake unloader, and Ingersoll-Rand plate inlet and discharge valves. An air receiver is mounted vertically in front of compressor outside of housing. A light steel canopy covers the compressor and motor. This canopy is provided with light steel doors which are easily removed.

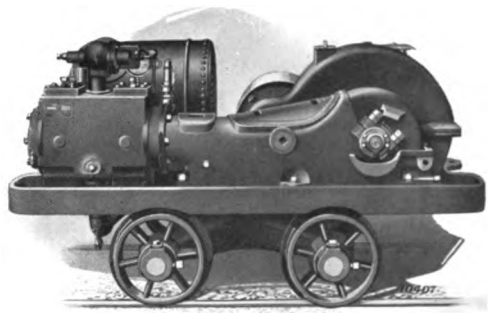
Bulletin 3215.

Compressor						Motor						Overall Dimensions Ft. and Ins.			Weights		Diam. Wheel Inches		Tread Ft. & Ins.
Bore	Stroke	P. D.	Actual	Air Press. Lbs.	B.H.P.	Current	Voltage	Phase	Frequency	Type	Make	Length	Width	Height	Net	Boxed	Front	Rear	
6	6	118	74	100	20	A.C.	220 440	2 or 3	60	Slip Ring	G.E. or West.	10-0	5-10	6-1	5000	5500	30	36	4-8
						D.C.	230	—		Compound	G.E. or West.				4400	4900			
						D.C.	400 600	—		Compound	G.E. or West.				4400	4900			

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Class "ER-1" Mine Car Portable Air Compressors

Discharge Pressures 90-100 Pounds



The Class "ER-1" Mine Car Compressor is a self-contained power plant consisting of an "ER" Compressor with automatic unloading device; air receiver with pressure gauge, safety valve, drain cock and service valve, D. C. or A. C. electric motor and control; gear drive; all mounted on a steel frame with car wheels and axles. It is fully equipped and needs only to be connected to a source of electric power. Can be furnished for any commercial track gauge.

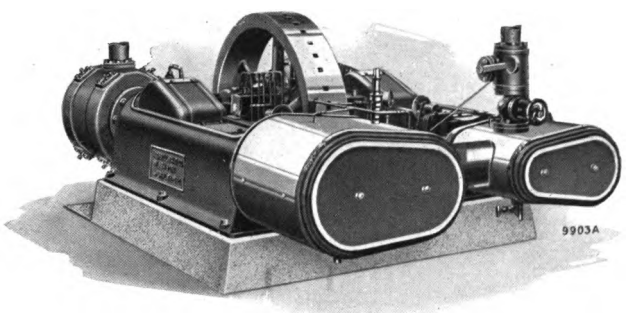
All compressor parts are enclosed to exclude dust and dirt yet are readily accessible by the removal of covers.

All sizes have the Hopper type of air cylinder water jacket cast integral. The air cylinder is provided with a sight feed lubricator and the reciprocating mechanism is automatically oiled by the splash system. Air intake and discharge valves are of Ingersoll-Rand plate type.

Piston Displ. Cu. Ft. per Min.	Air Pressure Designed For	Brake Horse Power	Overall Dimensions Feet and Inches			Standard Wheel Base		Net Wgt. lbs.
			Length	Width	Height over Rails	46″ Gauge and Under	Over 46″ Gauge	
78	90–100	12–12 5	7′	4′-0″	3′-8″	30	36	4000
145	90–100	23–24	8′-3″	4′-8″	4′-4″	36	42	6000
209	90–100	35–37	10′	5′-6″	4′-6″	36	42	8700
304	90–100	51–53	10′	5′-6″	4′-6″	36	42	9000

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"Imperial" Type XPV Gas Expanders



"Imperial" Type XPV Expanders in general follow the lines of our "XPV" Compressors described on pages 26-29 of this catalog, with such changes as have been found advisable to fit them for operation under the severe conditions imposed by this work.

The power end consists of piston valve power cylinders with adjustable cut-off permitting an adjustment of the amount of gas handled by the power cylinders and the amount of expansion. Special provision for insulation and lubrication have been made.

Details as to size, capacity, etc. furnished on receipt of specific inquiries.

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Gasoline Extraction Plants

Gasoline is frequently recovered from wet natural gas by compressing the latter and then cooling it. This process precipitates the liquid gasoline, which is then drained off and stored. The residue natural gas is suitable for its usual purposes. This industry has sprung up in the endeavor to recover from the natural gas, usually available at the head of oil wells, a valuable product which otherwise would be disposed of with the natural gas at only a fraction of its real worth.

The amount of gasoline per thousand cu. ft. of gas and also the pressure and temperature of precipitation are found to vary greatly with the locality. Therefore, it is advisable to make tests to determine the proper operating conditions before installing a plant.

In its simplest form a gasoline extraction plant generally consists of a vacuum pump to gather the gas from the wells, a gasoline extraction compressor, dirt separating receivers, gasoline extraction receivers, blending tanks, two coolers, gasoline traps, pipe and fittings and prime mover.

For this service we offer our Class "ER-2" straight-line power driven two stage compressor described on page 5, Class "FR-2" straight-line steam driven two-stage compressor described on page 9, or our "Imperial" Type XYB-2 two-stage, power driven compressor described on page 19, "Imperial" XB, X and "ER-1" and "FR-1" steam and power driven vacuum pumps, dirt separating receivers, gasoline extraction receivers and aftercoolers described on other pages of this catalog.

Expansion of Gas in Gasoline Extraction

In the compression system of gasoline extraction previously described, the final discharge pressure is generally in the neighborhood of 200 to 300 pounds per square inch, and at a temperature of about 80 degrees Fahr.

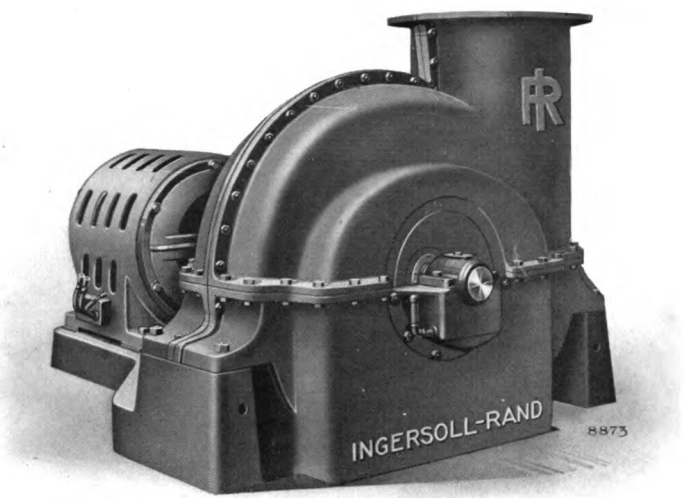
If this gas, or a portion of it, is expanded in properly designed cylinders from this high pressure to say 5 lbs. gage and made to do work while expanding its temperature will be greatly reduced. A final temperature of 50 degrees below zero or even lower may be reached. This cold gas can be used for cooling the gasoline bearing gas, in place of water, in most cases considerably increasing the gasoline yield of the plant.

The energy of expansion can also be utilized in power cylinders to compress fresh gasoline bearing gas or to drive vacuum pump cylinders or to drive low pressure cylinders to distribute the residue gas to its ultimate consumers, thus reducing the power requirements of the plant.

"Imperial" Type XPV Gas Expanders have been designed especially for this service, and are described more fully on page 41.

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Low Pressure Turbo Blowers



Blowers of the type illustrated above are of the single-stage, double-flow type and are built for discharge pressures ranging from one to four pounds. These units are available in sizes having capacities of from three thousand cubic feet to sixty thousand cubic feet per minute.

Ingersoll-Rand low pressure blowers are direct-connected by means of flexible coupling to electric motors or to steam turbines. These units are of the four-bearing type, the blower and the prime mover having independent shafts, each with two bearings.

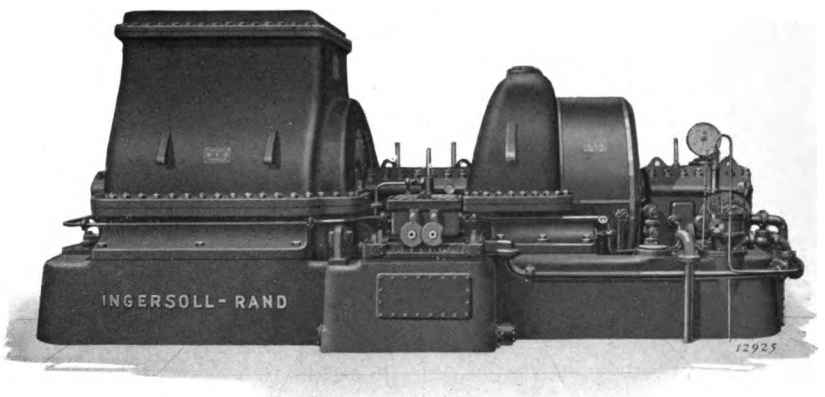
The blower casing is split horizontally permitting the removal of the upper half and affording ready access to the interior parts. Both blower and motor are mounted on a common cast iron sub-base which assures perfect alignment and rigidity.

Ingersoll-Rand low pressure blowers have been extensively used for furnishing air for oil burners and furnaces, blowing gas producers, cupola service, agitating and similar types of service requiring large volumes at low pressure.

Full information on request.

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Turbo Blowers



The large Turbo Blowers illustrated above are of the multi-stage, water-cooled type. They have been designed to meet the ever-increasing demand for centrifugal blowing units for iron blast furnaces, Bessemer converters, copper converters and for similar requirements. The blower and turbine casings are split horizontally permitting the removal of the upper half and affording ready access to the interior parts.

Blowers of this type are particularly suitable for drive by live steam turbines but they can also be furnished for mixed pressure steam turbine drive. Electric motor drive is not as desirable but can also be furnished.

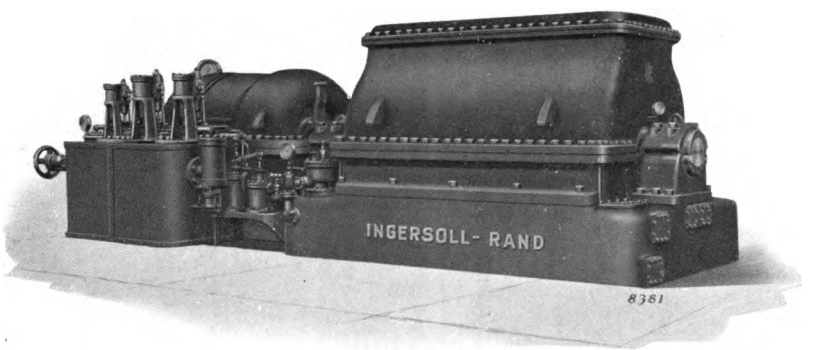
Blower and turbine are mounted on a common cast-iron sub-base which assures perfect alignment and rigidity.

This type of Turbo Blower is built for discharge pressures up to 30 pounds and for capacities from ten thousand to sixty thousand cubic feet of free air per minute.

Full information on request.

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Turbo Compressors



Where large volumes of compressed air at one hundred pounds discharge pressure are required, we offer our Turbo Compressors. In these units the turbo air compressor is direct-connected to an Ingersoll-Rand steam turbine. The centrifugal compressor is arranged for multi-stage compression and is water-cooled. The compressor and turbine casings are split horizontally permitting the removal of the upper half and affording ready access to the interior parts.

Compressors of this type are particularly suitable for drive by mixed pressure steam turbines, but they can also be furnished for live steam turbine drive.

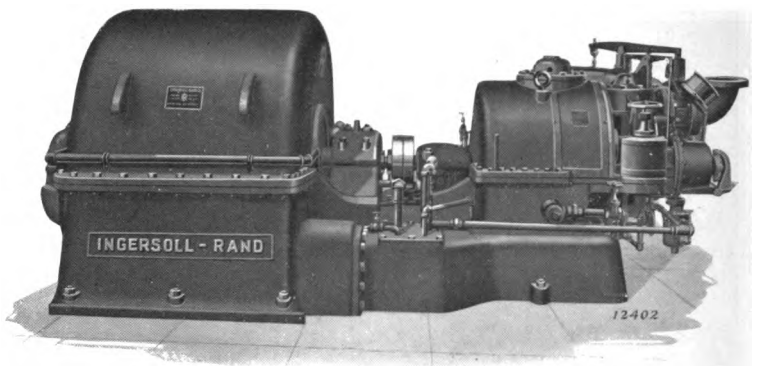
These units are furnished with both compressor and steam turbine mounted on a common sub-base.

Turbo Compressors are built for capacities of five thousand cubic feet of free air per minute and higher.

Full information on request.

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Gas Exhausters



Ingersoll-Rand Exhausters can be furnished for handling illuminating gas, coke oven gas and other similar gases. These units are available in sizes of greater than five thousand cubic feet of free gas per minute.

In general construction these Gas Exhausters are very similar to I-R Turbo Blowers described on Page 44, except that they are not water-cooled. The Exhauster casing is split horizontally permitting the removal of the upper half of the casing and affording ready inspection of interior parts.

The Exhauster may be direct-connected by means of flexible coupling to steam turbine or electric motor. Both Exhauster and prime mover are mounted on a common cast iron sub-base assuring perfect alignment and rigidity.

These Gas Exhausters may also be used as Gas Boosters.

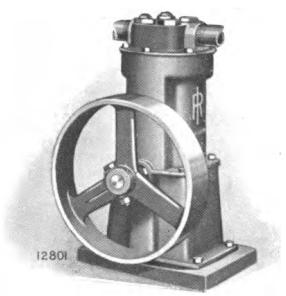
Full information on request.

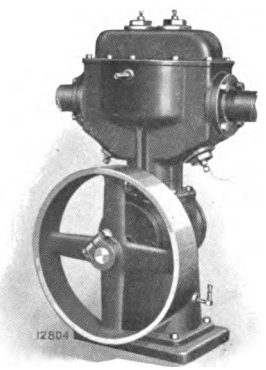
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"Imperial Type Fourteen" Power Driven Dry Vacuum Pumps





"Imperial Type Fourteen" Vacuum Pumps are built in two different styles, the smaller ones being single acting, while the two large sizes are double acting. The single acting pumps are equipped with "Mushroom" type of valves and the double acting pumps with Ingersoll-Rand plate inlet and discharge valves. They are of entirely enclosed construction, having a splash system of lubrication.

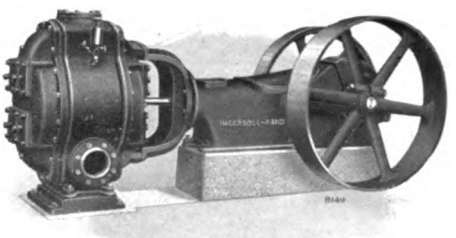
These units can be furnished for electric drive on special order.

Bulletin 3043.

Cylinder Inches		Speed R.P.M.	Piston Displacement Cu. Ft. per Min.	B. H. P. at Belt Wheel		Horse Power Motor Required	Belt Wheel Inches		Overall Dimensions—Inches		
Diam.	Stroke			Peak Load	28" Vacuum		Diam.	Face	Length	Width	Height
4	2	700	10.2	0.67	0.3	1	10	1¾	9½	10	15½
6	4	500	32.7	1.91	0.7	1½	16	3¼	14	16	25
8	5	450	65.5	3.70	1.3	3	20	4½	17	20	33
10	5	400	167.	7.0	2.5	5	20	4½	18	24	40
12	6	350	250.	10.0	3.5	7½	24	5½	22	26	47

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Class "ER-1" Belt Driven Dry Vacuum Pumps



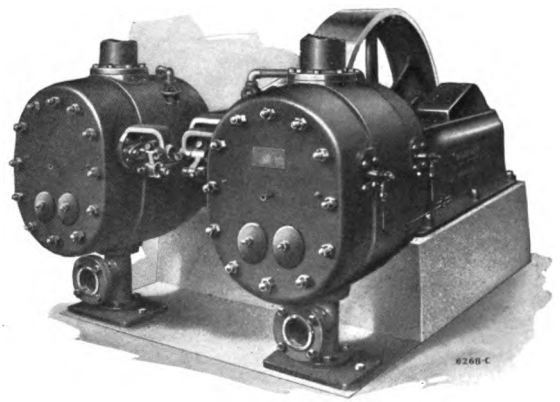
Ingersoll-Rand single-stage, double-acting, straight line vacuum pumps arranged for belt drive. They embody the most modern design in vacuum pump construction and have larger capacity per unit of floor space than any other vacuum pump on the market. They are suitable for general vacuum service, condenser work, etc. All running parts are enclosed, removable covers affording access for inspection. Running parts and main bearings are lubricated by automatic splash system, sight feed oiler supplying the cylinder. The inlet and discharge valves are the Ingersoll-Rand plate type with liberal port areas. These vacuum pumps can be furnished with short belt drive attachment, or with tight and loose pulleys for shaft drive.

Bulletin 3137.

Size of Cylinder Inches		Revolutions per Min.	Piston Displacement Cubic Feet per Min.	B. H. P. at Belt Wheel Peak Intake Atmospheric Discharge	Belt Wheel		Over-All Dimensions Feet and Inches		
Diam.	Stroke				Diam. Inches	Face Inches	Length	Width	Height from Floor
14	6	275	292	12	36	5½	7-0	1-11	3-10
18	6	275	483	20	36	5½	7-2	1-11	3-10
22	8	250	874	32	45	8½	8-6	2- 6	4- 3
26	10	235	1432	51	58	10½	10-5	3- 2	5- 1
31	12	220	2295	88	72	14½	12-4	4- 2	6- 3

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"Imperial" Type XB-1
Belt Driven Dry Vacuum Pumps

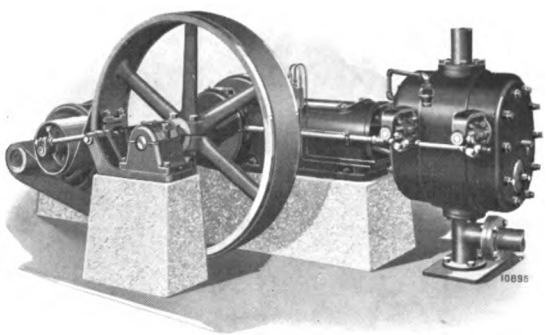


Duplex, power driven, dry vacuum pumps with single stage vacuum cylinders. They are of dust-proof enclosed construction with removable covers. Automatic flood lubrication for main bearings and driving parts, force-feed lubrication on cylinders. Equipped with "Imperial" Corliss Inlet Valves and Ingersoll-Rand Plate Discharge Valves. Can be furnished for short belt drive to electric motor. For special work where unusually high vacuum is required the cylinders may be connected in series thus giving a vacuum of within 0.1 inch of barometer on a closed intake. Bulletin 3138.

Cylinders—Inches		Rating						Floor Space Feet and Inches		
Diameter Each Duplex Vacuum Cylinder	Stroke	R.P.M.	Piston Displacement Cu. Ft. per Min.	B. H. P. Required at Belt Wheel of Vacuum Pump				Length	Width	Height from Floor
				Atmospheric Discharge						
				Peak Intake		28" Vac. Intake				
17	10	200	1048	39		18		7-10	5-6	5-2
20	12	190	1655	62		29		8-10	6-0	5-7
23	12	190	2188	82		39		10-4	6-7	6-1
27	14	170	3148	117		54		11-8	8-4	6-9
31	16	150	4184	155		72		13-2	9-2	7-9
36	16	150	5646	209		96		13-8	9-5	8-4
36	20	150	7058	264		122		16-0	9-11	8-9
				1 lb. Gage Discharge		5 lbs. Gage Discharge				
				Peak Intake	28" Vac. Intake	Peak Intake	28" Vac. Intake			
14	10	225	798	33	16	42	19	7-9	5-3	5-2
17	12	210	1320	55	26	69	30	8-8	5-9	5-7
20	12	210	1827	75	35	94	41	10-2	6-4	6-1
23	14	185	2484	101	47	127	54	11-5	8-0	6-9
27	16	170	3596	146	68	184	79	12-10	8-10	7-9
31	16	170	4738	192	89	241	103	13-4	9-0	8-4
32	20	150	5571	226	105	284	121	15-8	9-8	8-9

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"Imperial" Type XB½
Belt Driven Dry Vacuum Pumps

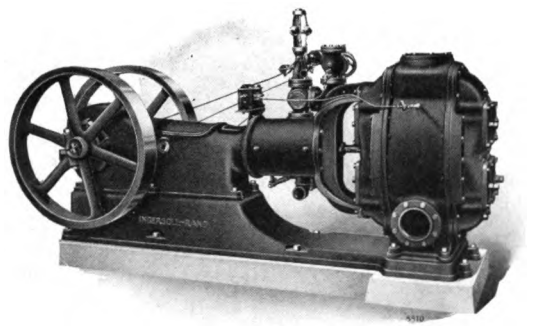


The "Imperial" Type XB½ Vacuum Pumps are constructed similar to the standard XB vacuum pumps described on page 3, except that they are ½ duplex with outboard bearings.

Size Cylinder		Rating				Size of Piping			Belt Wheel			Floor Space Ft. & Ins.		Domestic Shipping Weights	
Diam. Vacuum Cylinder	Stroke	R. P. M.	Piston Speed	**Piston Displacement Cu. Ft. per Min.**	B. H. P. required at Belt Wheel of Vacuum Pump at Peak Load	Inlet to Cylinder	Discharge from Cylinder	Circulating Water	Diameter	Face	Weight—Pounds	Length	Width	Complete Compressor	Heaviest Piece as Ordinarily Shipped
14	10	225	375	**399**	19	5	4	¾	54	10½	700	7-9	3-10	4020	3170
17	10	200	333	**524**	21	5	4	1	54	10½	700	7-10	4-1	4340	3490

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Class "FR" Steam Driven Dry Vacuum Pumps



Ingersoll-Rand single-stage, double-acting, straight line, steam driven vacuum pump, having steam cylinder located between main frame and vacuum cylinder. The refinement and modern design of the steam and vacuum cylinders of these machines insure a much larger capacity per unit of floor space and a much higher steam economy than is obtainable with the older type, long stroke, slow speed pumps. All running parts are enclosed. Removable covers afford instant access for inspection. Driving parts and main bearings are lubricated by automatic splash system and steam and vacuum cylinders by force-feed lubrication. Inlet and discharge valves are Ingersoll-Rand plate type. The piston steam valve permits the use of superheat and high steam pressure as well as saturated steam. These Vacuum Pumps are usually furnished with an adjustable speed throttling governor.

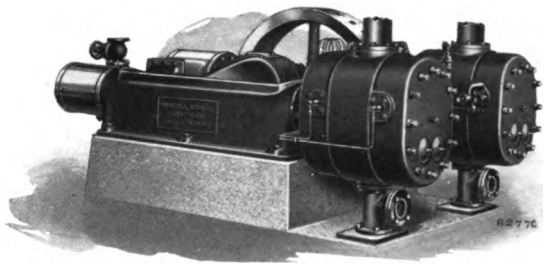
Bulletin 3137.

FOR STEAM PRESSURES 80 TO 120 POUNDS

Size of Cylinders Inches			Revolutions per Min.	Piston Displacement Cubic Feet per Min.	I. H. P. Steam Cylinder Peak Intake Atmospheric Discharge	Fly Wheel Diameter Feet and Inches	Over-All Dimensions Feet and Inches		
Diameter									
Steam	Air	Stroke					Length	Width	Height from Floor
6	14	6	275	292	12	2-6	8-7	2-3	3-6
7	18	6	275	483	20	2-6	8-9	2-3	3-6
9	22	8	250	874	32	3-5	10-7	2-8	4-0
12	26	10	235	1432	51	4-2	12-8	3-2	4-8
14	31	12	220	2295	88	5-3	15-0	4-1	5-9

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"Imperial" Type "X-1" Steam Driven Dry Vacuum Pumps



Duplex, steam driven vacuum pumps, with simple steam cylinders and single-stage vacuum cylinders. They are of dust-proof enclosed construction with removable covers. The 10″ and 12″ stroke sizes have "D" steam valve with fixed cut-off. Larger sizes have Meyer valve gear with hand adjustable cut-off. Automatic flood lubrication for main-bearings and driving parts, force-feed lubricators for cylinders. Vacuum cylinders are fitted with "Imperial Corliss" inlet valves and Ingersoll-Rand Plate discharge valves. Furnished with adjustable speed governor. For special work where unusually high vacuum is required the cylinders may be connected in series thus giving a vacuum of within 0.1″ of barometer on a closed intake.

For special conditions compound steam cylinders can be furnished.

Bulletin 3138.

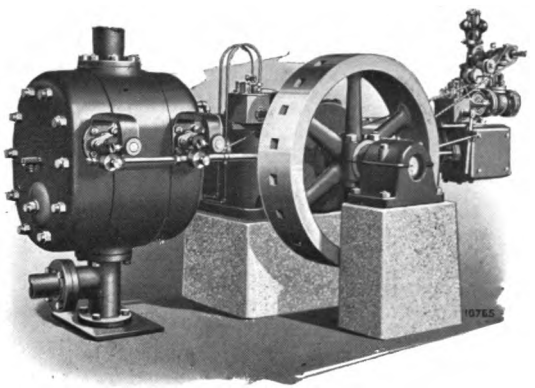
SIMPLE DUPLEX STEAM CYLINDERS *** STEAM PRESSURES 80 TO 120 LBS.**

Cylinders—Inches			Rating						Floor Space, Feet and Inches		
Diameter Each Duplex Steam Cylinder	Diameter Each Duplex Vacuum Cylinder	Stroke	R.P.M.	Piston Displacement Cu. Ft. per Min.	I. H. P. in Steam Cylinders				Length	Width	Height from Floor
					Atmospheric Discharge						
					Peak Intake		28″ Vac. Intake				
7	17	10	200	1048	39		18		9–0	5–6	6–4
8	20	12	190	1655	62		29		9–11	6–0	6–5
9	23	12	190	2188	82		39		11–0	6–7	6–9
10	27	14	170	3148	117		54		12–5	8–4	7–4
12	31	16	150	4184	155		72		14–1	9–2	7–10
14	36	16	150	5646	209		96		14–5	9–5	8–0
14	36	20	150	7058	264		122		17–0	9–11	8–2
					1 lb. Gage Discharge		5 lbs. Gage Discharge				
					Peak Intake	28″ Vac. Intake	Peak Intake	28″ Vac. Intake			
7	14	10	225	798	33	16	42	19	8–11	5–3	6–4
8	17	12	210	1320	55	26	69	30	9–9	5–9	6–5
9	20	12	210	1827	75	35	94	41	10–10	6–4	6–9
10	23	14	185	2484	101	47	127	54	12–2	8–0	7–4
12	27	16	170	3596	146	68	184	79	13–9	8–10	7–10
14	31	16	170	4738	192	89	241	103	14–1	9–0	7–0
14	32	20	150	5571	226	105	284	121	16–8	9–8	7–2

* Can be furnished with special steam cylinders for lower steam pressures.

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"Imperial" Type "X½" Steam Driven Dry Vacuum Pump



The "Imperial" Type "X½" vacuum pumps are constructed similar to thestandard "X" vacuum pumps described on page 6, except that they are ½ duplex with outboard bearings.

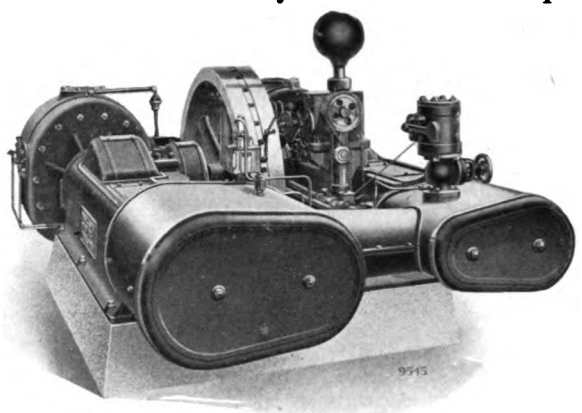
*** STEAM PRESSURES 80 TO 120 LBS.**

Size Cylinders			Rating				Size of Piping					Fly Wheel		Floor Space Ft. & Ins.		Domestic Shipping Weights	
Diam. of Steam Cylinder	Diam. of Vacuum Cylinder	Stroke	R. P. M.	Piston Speed	**Piston Displacement Cu. Ft. per Minute**	I. H. P. in Steam Cylinders at Peak Load	Steam	Exhaust	Inlet to Vacuum Cylinder	Discharge from Vacuum Cyl.	Circulating Water	Diameter	Weight	Length	Width	Complete Compressor	Heaviest Piece as Ordinarily Shipped
7	14	10	225	375	**399**	19	2	2½	5	4	¾	36	700	8′-11″	3′-8″	4730	3880
7	17	10	200	333	**524**	21	2	2½	5	4	1	36	700	9′-0″	3′-11″	5050	4200

*** Can be furnished with special steam cylinder for lower steam pressures.**

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"Imperial" Type "XPV-1" Steam Driven Dry Vacuum Pumps



The steam driven vacuum pumps described on page 6 of 14 inch stroke and larger can be furnished with a piston valve steam end in which the "Imperial" Piston Steam Valve is used. The machines are then known as the "XPV" type and are equipped exactly as those described on page 6. This Piston valve is a perfectly balanced valve of the telescopic type and is equipped with cut-off valves. It is especially adapted to high steam pressures and high superheat as well as for ordinary saturated steam conditions. Furnished with "Imperial" "XPV" Automatic Cut-off governor of the adjustable speed type. For special work where unusually high vacuum is required the cylinders may be connected in series thus giving a vacuum of within 0.1" of barometer on a closed intake. For special conditions compound steam cylinders can be furnished. Bulletin 3138.

SIMPLE DUPLEX STEAM CYLINDERS — *** STEAM PRESSURES 80 TO 120 LBS.**

Cylinders—Inches			R.P.M.	Piston Displacement in Cu. Ft. per Min.	I. H. P. in Steam Cylinders				Overall Dimensions Feet and Inches		
					Atmospheric Discharge						
Diam. each Duplex Steam Cylinders	Diam. each Duplex Vacuum Cylinders	Stroke			Peak Intake		28" Vac. Intake		Length	Width	Height from Floor
10	27	14	170	**3148**	117		54		11–8	8–4	6–1
12	31	16	150	**4184**	155		72		13–2	9–2	6–8
14	36	16	150	**5646**	209		96		13–8	9–5	6–5
15	36	20	150	**7058**	264		122		16–0	9–11	6–6
					1 lb. Gage Discharge		5 lbs. Gage Discharge				
					Peak Intake	28" Vac. Intake	Peak Intake	28" Vac. Intake			
10	23	14	185	**2484**	101	47	127	54	11–5	8–0	6–1
12	27	16	170	**3596**	146	68	184	79	12–10	8–10	6–8
14	31	16	170	**4738**	192	89	241	103	13–4	9–0	6–5
15	32	20	150	**5571**	226	105	284	121	15–8	9–8	6–6

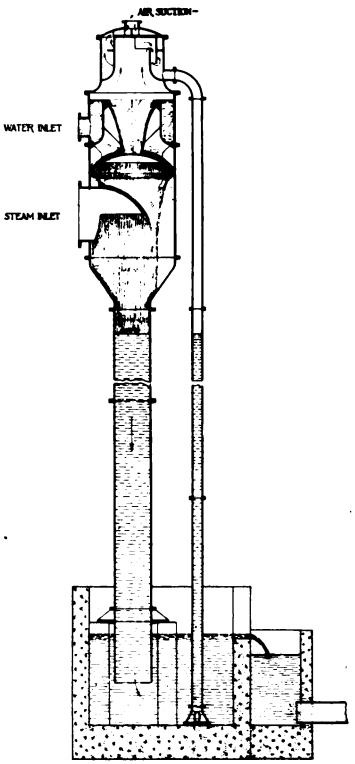
* Can be furnished with special steam cylinders for lower steam pressures.

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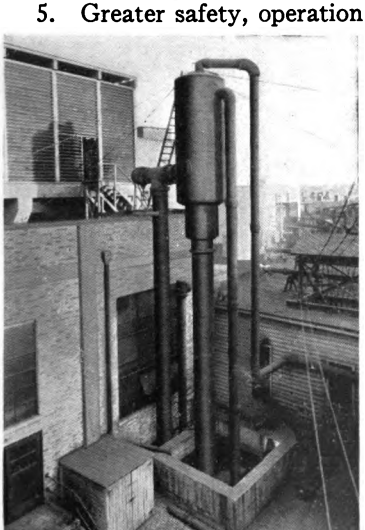
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I-R Barometric Counter-Current Condensers



This condenser is of the barometric or high level construction. The steam is admitted at the bottom of the condensing chamber, is condensed and removed by gravity along with the cooling water through the barometric pipe and discharged into a hot well. Air and non-condensable vapors pass upward through the falling water and are finally removed from the top of the condenser shell by a vacuum pump. This construction results in the following advantages:

1. A counter-current construction insuring small terminal temperature difference between steam and hot water, and at the same time cold air temperature insuring the most effective air removal.
2. Less water used than with any other type, resulting in a great power saving in operating auxiliaries.
3. Specially adapted to fluctuating loads; greater stability; better vacuum obtained, or higher average operating efficiency with varying load conditions.
4. Adaptability as a central condensing plant taking steam from a number of small or large prime movers. This means great simplicity of installation, low first cost and low subsequent cost of upkeep.
5. Greater safety, operation being independent of vacuum breakers or atmospheric relief valves. The steam can be blown directly through the barometric condenser, if necessary.



Condensers

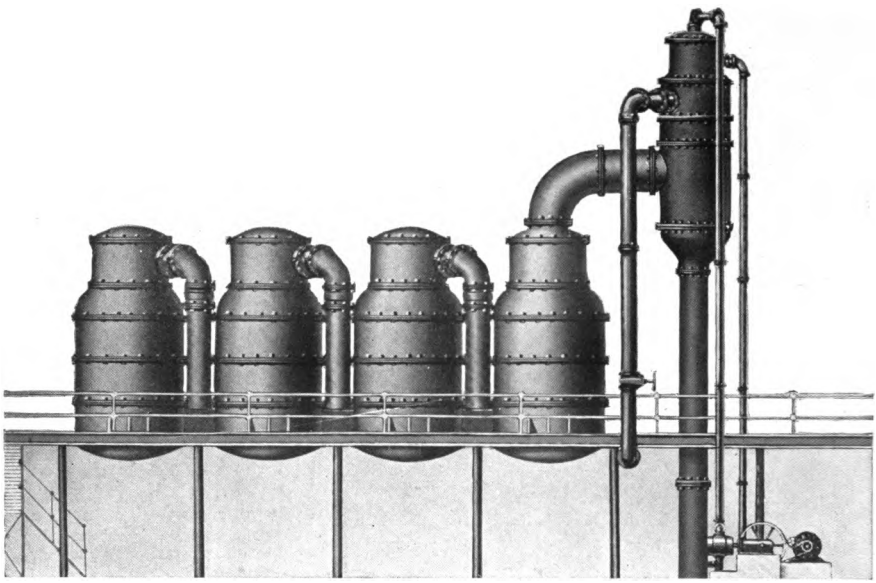
6. Greater flexibility, water and vacuum pumps are independent and can be regulated to suit varying water temperatures and conditions.
7. Results are not dependent upon constant attention, permitting the use of dirty, gritty or acid circulating water continuously without cleaning or repair.
8. Extraordinary reliability under all conditions.

AUXILIARIES

Auxiliaries used with Barometric Counter-Current Condensers are Ingersoll-Rand vacuum pumps and Cameron high efficiency centrifugal water pumps. Bulletin 9224.

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Ingersoll-Rand Barometric Counter-Current Condensers for Evaporators, Multiple Effects and Vacuum Pans



These condensers are widely used in connection with sugar evaporators and vacuum pans, also evaporators and multiple effects in a great many other industries. They are ideally adapted to this service because:

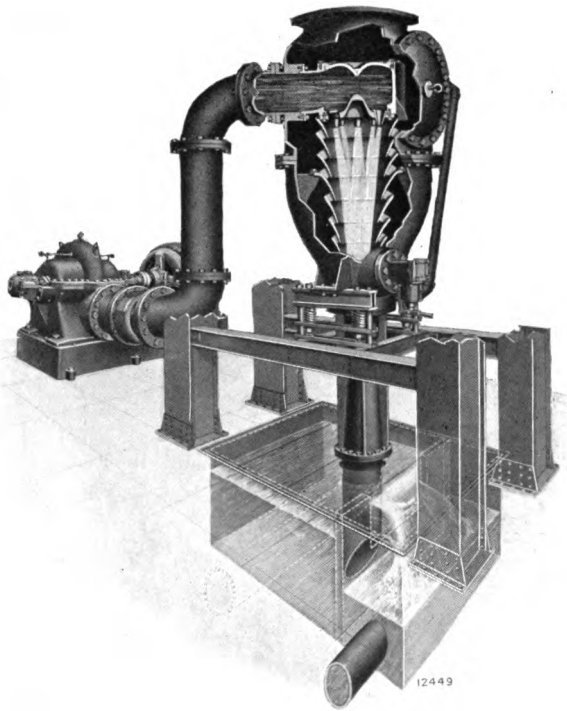
First, the counter-current construction insures cold air passing to the vacuum pump, and therefore the ability to maintain high vacuum under conditions of heavy air leakage, such as may be met in practice. Liberal ratings for the vacuum pumps on condensers in this service are always made.

Second, this condenser uses a minimum amount of water, which is usually of great importance because water has frequently to be recooled by a spray pond or cooling tower. In other cases the water has to be pumped great distances, so that in general the investment charge and power charge for water is a considerable item.

Third, these condensers are simple in construction, having no internal moving parts nor anything to get out of order or become inoperative at times when the output of an evaporator may depend on the reliable performance of the condensing plant. Bulletin 9028.

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I-R Low Level Multi-Jet Condensing Plants



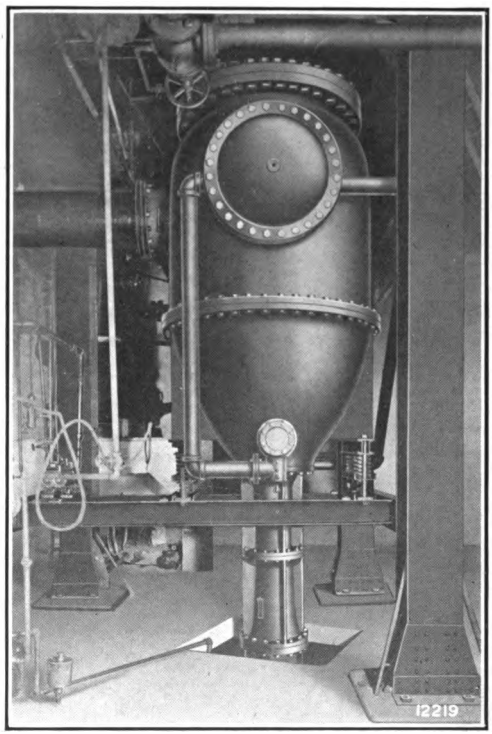
The Ingersoll-Rand Low Level Multi-Jet Condensing plant consists of a standard high efficiency centrifugal pump discharging water under pressure to a Multi-Jet Condensing head. The water is discharged from a set of nozzles in multiple jets which flow at high velocity through a combining tube where the condensation takes place. Steam enters either at the top or side. The cooling water, the condensed steam and the air and non-condensable vapors are ejected through a "Venturi" throat, in which the pressure is raised from a high vacuum to atmosphere. The mixture is then discharged to a sump from which it flows to waste or to the suction of a pump serving a pond or cooling tower.

Vacuums of 28 inches at full load in the summer and 29 inches in the winter are regularly maintained. No air pump is needed under any conditions.

The whole plant is extremely rugged and simple. The pump itself is a standard high efficiency split case pump, which is accessible at all times for inspection and repair. Furthermore, by reason of its handling only cold water under moderate suction lift conditions, the life of the impeller is relatively long as compared to the life of impellers removing hot water at high vacuum from an ordinary Low Level Jet Condenser. Bulletin 9032.

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I-R Low Level Multi-Jet Condensing Plants



The Condenser itself is of extreme simplicity, and has no parts subject to wear or likely to get out of order. Water nozzles are of bronze, as are also the lower rings of the combining tube and the tail pipe bushing. These features result in sustained reliable performance with minimum shut-downs for repair and replacements.

In order to remove the air by ejection and eliminate a vacuum pump, more water is used with this condenser than with the ordinary type of low level jet condenser, but all the water is pumped by a centrifugal pump operating under efficient suction lift conditions. This results in lower power consumption. In addition no air pump at all is required. With the customary type of low level jet the power required by the air pump, or steam jet capacity needed for air removal, is relatively large.

These condensers are built in a wide range of standard sizes suitable for anything from a 100 H. P. engine to the larger steam turbines.

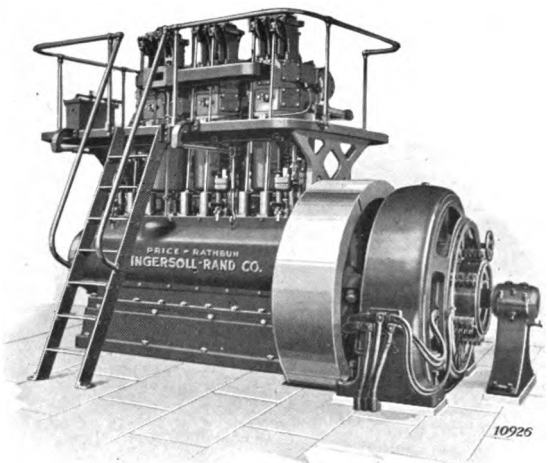
Bulletin 9032.

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Type "PR" Stationary Oil Engines



Stationary Oil Engine—Type P-R.
Vertical, Multi-Cylinder, Four Cycle, Solid Injection,
Low Compression, Diesel Economy

Low Compression—Pressures and temperatures a great deal less than those prevailing in Diesel type, are employed resulting in a minimum amount of wear and tear on engine parts and a low up-keep cost.

No Hot Bulbs or Hot Spots—All parts of head and cylinder are efficiently water cooled.

High Fuel Economy—Fuel economies of less than .5 lbs. /B.H.P. may be conservatively guaranteed. The consumption curve between full load and half load is practically flat. The combination of low compression and high economy is possible on account of highly developed system of handling fuel.

Construction—This engine is the result of twenty years' experience in building internal combustion engines and twelve years' experience in building oil engines. The design has been purposely simplified so that the highly skilled and high-priced attendance required by the Diesel type is rendered unnecessary.

Solid Injection—The elimination of the injection air compressor saves the owner many valuable square feet of floor space end obviates one of the objectionable features of the Diesel engine.

Service—The engine is designed for direct connection to generator, pump or vertical air compressor. The flywheel may be crowned or a special belt pulley provided for transmitting power by belt drive.

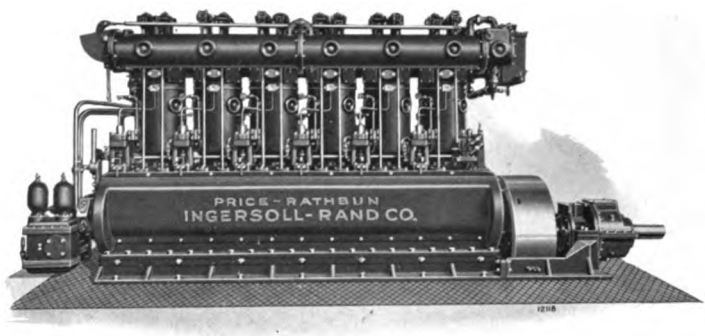
Parallel operation—Parallel operation of alternating current generators is guaranteed with other units of similar make or engines of other make which have demonstrated their ability to parallel.

Lubricating Oil Consumption—A consumption of 4000 rated B.H.P. hours per gallon will be guaranteed with the knowledge that actual consumptions will be probably half of that.

Sizes—105, 150, 210, 300, 400, 500, 600, 800 and 1000 B.H.P. Bulletin 10,002.

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Type "PR" Marine Oil Engines



Marine Oil Engine—Type P-R.
Vertical, Multi-Cylinder, Four Cycle, Solid Injection,
Low Compression, Diesel Economy, Directly Reversible

Low Compression—Pressures and temperatures a great deal less than those prevailing in Diesel type, are employed resulting in a minimum amount of wear and tear on engine parts and a low up-keep cost.

No Hot Bulb or Hot Spots—All parts of head and cylinder are efficiently water cooled.

High Fuel Economy—Fuel economies of less than .5 lb./B.H.P. may be conservatively guaranteed. The consumption curve between full load and half load is practically flat. The combination of low compression and high economy is possible on account of highly developed system of handling fuel.

Reversibility—Average time required for reversing from full speed ahead to to full speed astern is seven seconds. The operation is accomplished by interchanging the functions of the exhaust and intake valves. There is no shifting of the cam shaft which permits the engine to be reversed as many times as desired without strain or wear.

Accessibility—Appreciating the difficulties of working in a seaway, all parts have been made easily and quickly accessible for inspection and repair.

Construction—The design conforms to the best marine practice. The construction is simple and rugged, yet the weight per B.H.P. is less than 250 pounds.

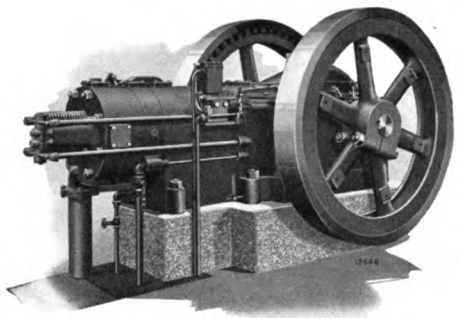
Solid Injection—The elimination of the injection air compressor, in addition to reducing the engine's length, makes it as reliable as a steam engine.

Sizes—220, 300, 500 and 750 B.H.P.

Bulletin 10,003.

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Type "PO" Stationary Oil Engine



Stationary Oil Engine—Type PO
Horizontal, Single Cylinder, Four Cycle, Solid Injection,
Low Compression, Diesel Economy

Low Compression—Pressures and temperatures a great deal less than those prevailing in Diesel type, are employed resulting in a minimum amount of wear and tear on engine parts and a low up-keep cost.

No Hot Bulbs or Hot Spots—All parts of head and cylinder are efficiently water cooled.

High Fuel Economy—Fuel economies of less than .5 lb./B.H.P. may be conservatively guaranteed. The consumption curve between full load and half load is practically flat. The combination of low compression and high economy is possible on account of highly developed system of handling fuel.

Construction—This engine is the result of twelve years' experience in building horizontal oil engines. The engine is so perfectly balanced as to be entirely free of vibration. The number of moving parts has been reduced to a minimum with a resulting unusually high mechanical efficiency. The construction is strong and rugged and the design is so simple that skilled attendance is unnecessary.

Solid Injection—One of the most valuable features of this engine is the elimination of the injection air compressor of the Diesel engine, which has proven itself to be troublesome, space consuming and expensive in first cost and in operating cost.

Service—The engines may be direct connected to electric generator, pump or air compressor. The 45 H.P. size has a specially designed vertical compressor which is mounted above the engine crankshaft. The 90 H.P. compressor unit is of the horizontal line type. A flywheel with a 12 inch crowned face or a special belt pulley may be provided for belt drive.

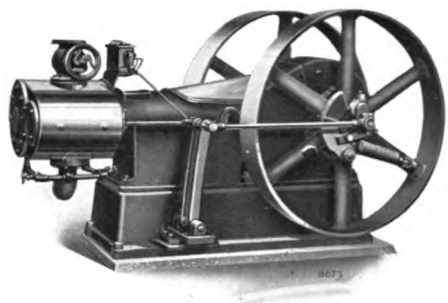
Lubricating Oil Consumption—A consumption of 4000 rated B.H.P. hours per gallon will be guaranteed with the knowledge that actual consumptions will be probably half of that.

Sizes—45 and 90 B.H.P.

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"Ingersoll-Rand" Type "FP" Steam Engine

Steam Pressures 80 to 175 Pounds.



Ingersoll-Rand Type "FP" Horizontal Center Crank, High Speed Steam Engine. It is entirely self contained, having Automatic Splash Lubrication, and Liberal Bearing Surfaces, Dust-proof Enclosed Construction with removable covers, Balanced Piston Steam Valve. Equipped with Automatic Cut-off Control.

Bulletin 9026.

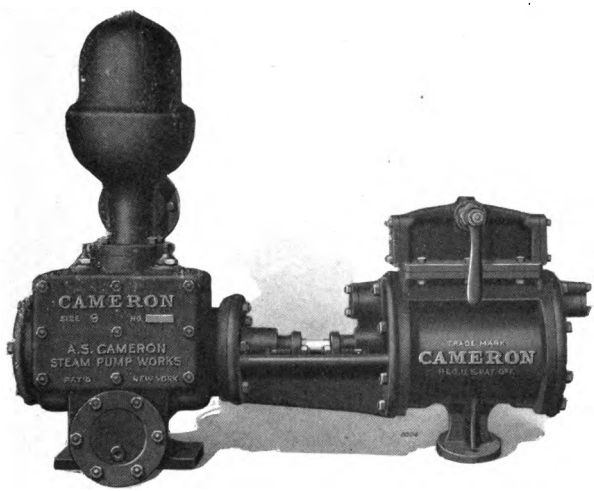
Diam. Cylinder Steam Pressure 80-120 lbs.	Diam. Cylinder Steam Pressure 125-175 lbs.	Stroke Inches	Revolutions per Minute	Indicated Horse-Power	Brake Horse-Power	Belt Wheel — Standard Size shown in heavy type Others can be furnished without Extra Cost		Over-all Dimensions Feet—Inches		
						Diam. Inches	Diam. Inches	Length	Width	Height from Floor
7	6	6	350	15	12	21 24 **36**	8½ 5½ **5½**	5-5	2-3	3-6
9	8	8	300	30	25	38 39 **45**	10½ 8½ **8½**	7-0	2-8	4-0
12	10	10	275	60	53	34 48 **58**	12½ 10½ **10½**	8-3	3-2	4-8
14	12	12	250	90	81	60 **72**	14½ **14½**	9-10	4-1	5-9

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Cameron Simplex Direct Acting Pumps



Type "GSS" Regular Pattern Piston Pump

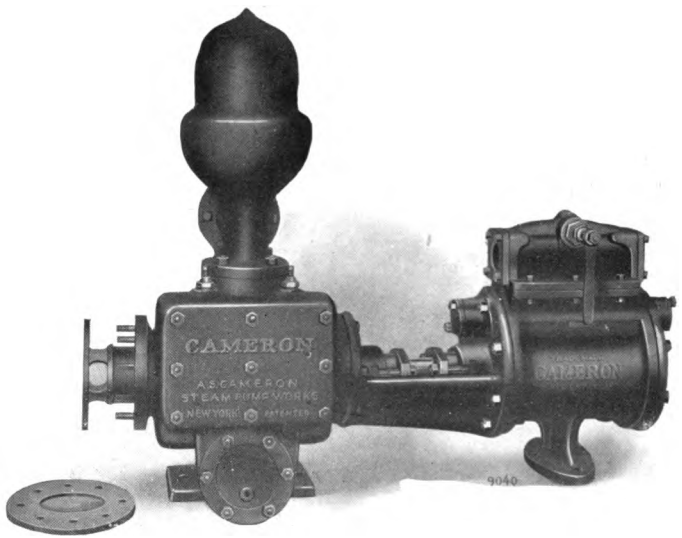
This type is designed for general service and boiler feeding. It is made either with iron water cylinder bronze lined, and bronze piston rod, or with removable bushing, as described on page 2.

Size No.	Diameter of Steam Cylinder, Inches	Diameter of Water Cylinder, Inches	Stroke of Piston, Inches	Ratings				Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Floor Space	Weight
				On General Service (Must be Reduced 20% if Suction Lift is High)		On Boiler Feed Service. (Basis 34.5 lbs. Water Evaporated per Boiler H.P.)							
				Gals. per Min.	Piston Speed	Horse Power	Piston Speed						
1	4	2	6	12	75	90	38	⅜	½	1¼	1	40″x10″	250
2	5	2½	6	19	75	140	38	½	¾	1½	1¼	40″x10″	275
3B	6	4	7	49	75	359	38	½	¾	2½	2	47″x14″	475
4A	7	4	7	49	75	359	38	¾	1	2½	2	47″x15″	490
3D	6	4	12	81	125	580	63	¾	1	3	2½	4′10″x17″	725
6	8	4	12	81	125	580	63	1	1½	3	2½	4′10″x18″	945
5B	7	5	13	130	128	942	64	1	1½	4	3	5′3″x20″	1175
7	10	5	13	130	128	942	64	1	1½	4	3	5′5″x23½″	1505
..	10	7	13	206	103	1500	52	1	1½	5	4	5′5″x23½″	1880
9	12	7	13	206	103	1500	52	1½	2½	5	4	5′6″x24″	2065
10	14	9	18	248	75	1817	38	2	3	6	5	6′9″x30″	3320
..	14	10	18	408	100	2956	50	2	3	8	6	7′6″x30″	3785
..	16	10	18	408	100	2956	50	2½	4	8	6	7′6″x37″	5170
..	16	12	20	510	87	3743	44	2½	4	10	8	8′5″x41″	5695
12	18	12	20	510	87	3743	44	3	4	10	8	8′5″x41″	6170

Bulletin 7304

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Cameron Simplex Direct Acting Pumps



Type "GSS" with Removable Bushing

Bulletin 7304

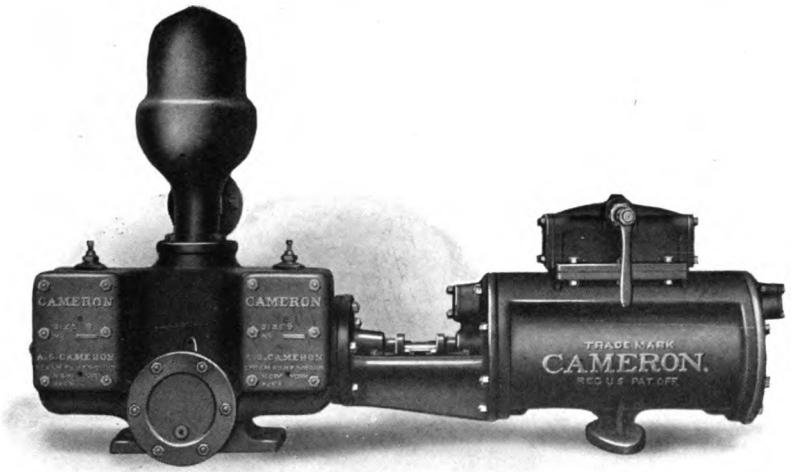
Where mine water is very gritty and the use of a plunger pump is prohibited on account of limited space or other circumstances, to secure the greatest durability possible with a piston pump, we supply a removable bushing of iron or bronze. This bushing can be turned in the pump so that the wear can be distributed over every portion of its surface. Furthermore, if the depth of the mine is increased, and it becomes necessary for the pump to be placed lower, the removable bushing can be replaced by one of smaller diameter, thus changing the proportions of the pump, and enabling it, within certain limits, to work against a greater head.

This pump is also furnished with the entire water cylinder and bushing made of iron; iron water piston and long body piece, for handling alkaline liquids.

On page 2 is given full information as to sizes and capacities for ordinary service.

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Cameron Simplex Direct Acting Pumps



Long Stroke Piston Pump Type "ELS"

This type is especially adapted for rolling mills, blast furnaces, sugar or oil refineries, and other situations where continuous pumping is required. Its stroke being nearly twice the length of that of the "regular "type, all working parts except pistons and rod, are brought into action only half the number of times for the same piston speed; wear and tear is reduced and the life of the pump prolonged accordingly. Valve chests are placed at both ends of the water cylinder, thus making the water passages short and direct.

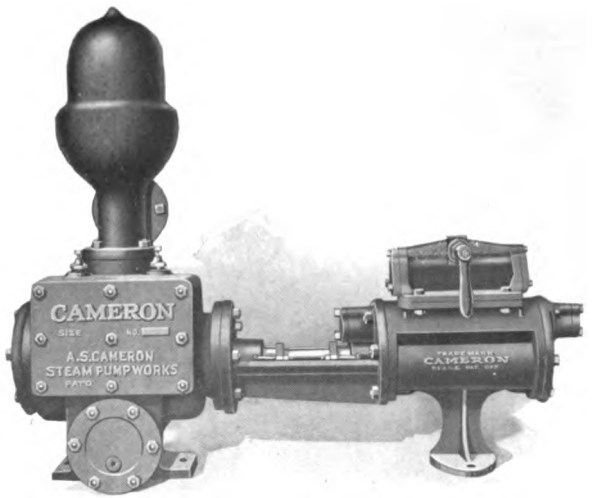
This pump is made either with iron water cylinder unlined, and steel piston rod, or with water cylinder lining, piston and piston rod of bronze.

Bulletin 7304.

Size No.	Diameter of Steam Cylinder, Inches	Diameter of Water Cylinder, Inches	Stroke of Piston, Inches	Ratings				Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Floor Space	Weight
				On General Service (Must be Reduced 20% if on Long Suction Lift)		On Boiler Feed Service. (Basis 34.5 lbs. Water Evaporated per Hour per Boiler Horsepower)							
				Gals. per Min.	Piston Speed	Horse Power	Piston Speed						
7	10	5	25	130	128	942	64	1¼	2	5	3½	22"x7'3"	1610
8	10	6	25	130	88	942	44	1¼	2	5	3½	22"x7'3"	1660
9	12	7	25	224	112	1623	56	1½	2½	6	4	24"x7'6"	1840
10	14	9	33	412	125	2985	63	2	3	8	6	30"x9'10"	3520
11	16	10½	33	486	115	3521	57	2½	4	10	8	36"x10'2"	5970
12	18	12	38	516	88	3738	44	3	4	12	10	42"x11'10"	7500

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Cameron Simplex Direct Acting Pumps



Regular Light Service Pattern Type "LSS"

This pump is adapted for filling tanks, irrigating and light duty generally, in factories, and for situations where a considerable quantity of water is to be lifted to a limited elevation. It is not proportioned for mining work, nor to force water against heavy lifts, as the steam cylinder is relatively smaller in diameter, but the water cylinder is strongly built and of the standard type.

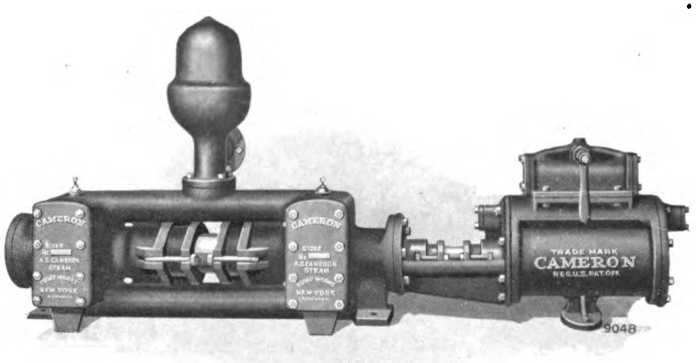
This pump is made either with iron water cylinder, bronze lined and bronze piston rod, or with removable bushing, as described on page 2.

Bulletin 7304.

Diameter of Steam Cylinder, Inches	Diameter of Water Cylinder Inches	Stroke of Piston, Inches	Ratings				Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Floor Space	Weight
			On General Service (Must be Reduced 20% if Suction Lift is High)		When Handling Viscous Fluids (Fluid Must Always Flow to Pump Under a head)							
			Gals. per Min.	Piston Speed	Gals. per Min.	Piston Speed						
4	4	7	48	75	24	38	3/8	1/2	2 1/2	2	33″x16″	385
5	5	7	82	81	41	41	1/2	3/4	3	2 1/2	48″x18″	590
6	6	7	128	88	64	44	3/4	1	4	3	4′2″x20″	950
7	7	13	204	100	102	50	1	1 1/2	5	4	5′6″x24″	1725
8	8	13	247	95	123	48	1	1 1/2	6	5	5′7″x27″	2490
10	10	18	416	100	208	50	1 1/4	2	8	6	7′4″x30″	4250
12	12	20	505	88	252	44	1 1/2	2 1/2	10	8	8′0″x37″	4930
14	14	20	822	102	411	51	2	3	12	10	8′4″x42″	7000
16	16	20	1252	120	626	60	2 1/2	4	12	10	10′0″x47″	7900

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Cameron Simplex Direct Acting Pumps



Outside Packed Plunger Pump—Regular Pattern
Type "CPS"

This pump is especially adapted for station duty in mines, and is far more durable than a piston pump for handling gritty water. There are no wearing parts in the water end except the packing in the stuffing boxes, which can be instantly adjusted from the outside.

Since the plunger works through glands, the pump barrel cannot be cut or worn by grit or sand, and the stuffing boxes are placed in the center, so that there is no tendency for the plunger to sag. It is more compact than any other make of plunger pump, and has no outside rods or cross-heads. It is also adapted for feeding boilers under heavy pressure.

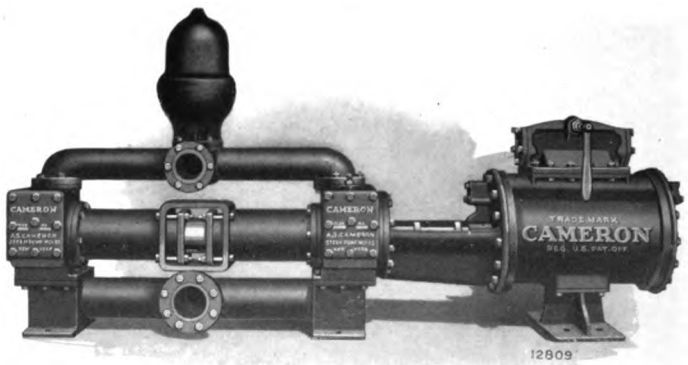
This pump is made with iron plunger and steel piston rod, or with bronze plunger and piston rod.

Bulletin 7304

Size No.	Diameter of Steam Cylinder, Inches	Diameter of Plunger, Inches	Stroke of Piston, Inches	Ratings				Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Floor Space	Weight
				On General Service (Must be Reduced 20% if Suction Lift is High)		On Boiler Feed Service—Basis 34.5 lbs. Water Evaporated per Boiler H.P.							
				Gals. per Min.	Piston Speed	Horse Power	Piston Speed						
A	4	2	6	12	75	87	37	⅜	½	1¼	1	9″x4′7″	290
BB	7	3½	7	47	97	340	48	¾	1	2	1½	13″x5′3½″	590
C	8	4	12	81	125	580	63	1	1½	3	2½	19″x7′3″	1260
D	10	5	13	130	128	942	64	1¼	2	4	3	21″x7′8″	1895
..	12	5	13	130	128	942	64	1½	2½	4	3	21″x7′8″	2245
E	12	6	18	205	140	1477	70	1½	2½	5	4	26″x9′5″	3210
..	14	6	18	205	140	1477	70	2	3	5	4	26″x9′9″	3700
F	14	8	18	240	92	1740	46	2	3	6	5	31″x11′6″	4720
..	16	8	18	240	92	1740	46	2½	4	6	5	31″x11′6″	4970

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Cameron Simplex Direct Acting Pumps



Outside Packed Plunger Pump—Pipe Pattern
Type "PPS"

This pump does very effective work under the most severe conditions, especially where the water contains sand, grit or acids. While no iron can indefinitely resist the action of acid water, yet solid bronze water ends are very costly, but as this pump is built practically in sections, any part may be replaced at a minimum expense.

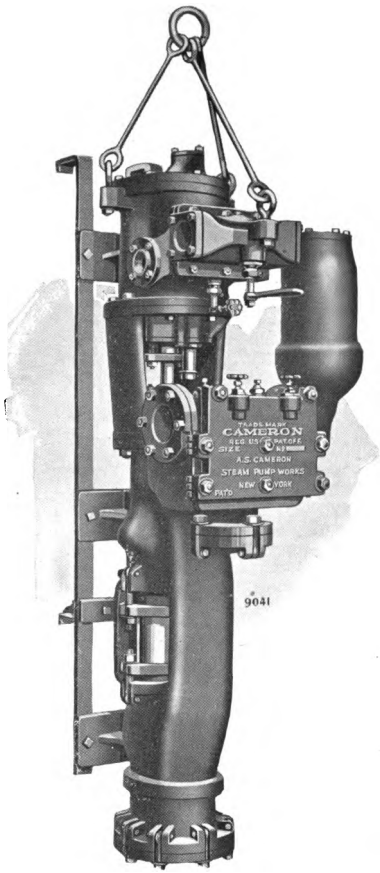
It has no outside parts. The plunger is supported in the stuffing boxes, so that it cannot sag or get out of line at the end of the stroke. All parts are readily accessible. The water end is made exceptionally heavy, and has large valve area. All the improvements that years of experience in mining work have suggested are embodied in this type.

This pump is made with iron plunger and steel piston rod, or with bronze plunger and piston rod.

Bulletin 7304

Diameter of Steam Cylinder, Inches	Diameter of Plunger, Inches	Stroke of Piston, Inches	Displacement, Gals. per Min.		Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Weight
			Normal	Maximum					
18	8	33	270	335	3	4	6	5	7226
14	9	18	370	460	2	3	8	6	7200
14	9	33	370	460	2	3	8	6	7807
16	10½	20	425	525	2½	4	10	8	9070
16	10½	33	425	525	2½	4	10	8	9814
18	12	20	500	625	3	4	10	8	12100
22	14	20	800	1000	4	5	12	10	15500
24	14	36	800	1000	4	5	12	10	18980
28	16	36	950	1185	5	6	12	10	21300

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Vertical Plunger Sinking Pump, Type "VPS"

Cameron Simplex Direct Acting Pumps

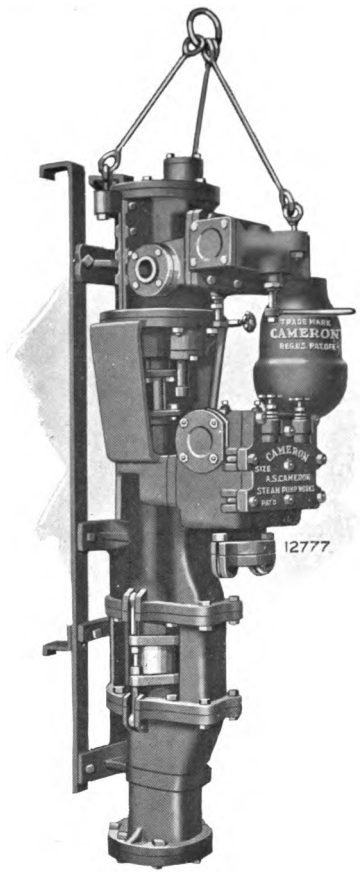
This is the most successful sinking pump that has ever been placed on the market. Any steam pump that is to be used in sinking a mine shaft must be strong, certain in operation, capable of handling gritty water, require little attention, and above all, be able to stand the roughest kind of usage without sustaining injury.

This pump retains all the advantages of the horizontal types of *Cameron* pumps besides having several features of importance for a sinking pump. It has no exposed parts liable to breakage; it takes up less room in the shaft than any other make of pump; it cannot be damaged by collision with the side walls; it is not likely to be injured by blasts; and it is designed and intended to handle gritty water.

Bulletin 7304.

Size No.	Diameter of Steam Cylinder Inches	Diameter of Plunger, Inches	Stroke of Piston, Inches	Ratings (Must be Reduced 20% if Suction Lift is High)		Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Shaft Space, Inches	Weight
				Gals. per Minute	Piston Speed						
6	8	4	12	83	128	1	1½	3	2½	25x25	1500
7	10	5	13	130	128	1½	2	4	3	31x30	2380
..	12	5	13	130	128	1½	2½	4	3	32x31	2600
9	12	7	13	206	103	1½	2½	5	4	34½x34	3550
9B	14	7	13	206	103	2	3	5	4	37¼x37	3700
12	18	9	16	247	75	3	4	6	5	42x45	6285
..	16	10½	16	427	95	2½	4	8	6	52x62	6500
..	18	10½	16	427	95	3	4	8	6	52x62	6650

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"Sierras" Pattern Sectionalized Vertical Plunger Sinking Pump Type "SVS"

Cameron Simplex Direct Acting Pumps

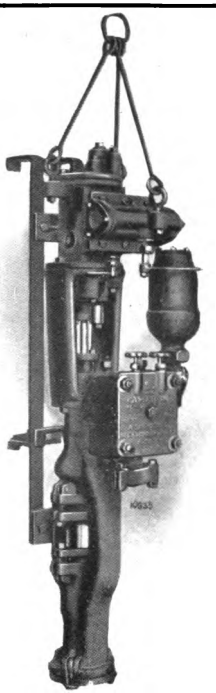
This is our regular vertical plunger pump, built in section, the heaviest piece weighing not over 300 pounds.

This pump has found its way on mule back and by other primitive modes of transportation over the Mountain Passes of Mexico, Colombia, Peru, Chili, and to other remote mining regions in various parts of the world.

Bulletin 7304.

Diameter of Steam Cylinder, Inches	Diameter of Plunger, Inches	Stroke of Piston, Inches	Displacement, Gals. per Min.		Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Space Occupied in Shaft, Inches	Weight
			Normal	Maximum						
8	4	12	65	81	1	1½	3	2½	25x25	1502
10	5	13	100	125	1¼	2	4	3	31x30	2560
12	5	13	100	125	1½	2½	4	3	32x33	2750
10	6	13	125	155	1¼	2	4	3½	31x31	2560
12	6	13	125	155	1½	2½	4	3½	32x33	2750

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Prospector's Sinking Type

Cameron Simplex Direct Acting Pumps

Cameron Prospector's Sinking Pump

This type is very similar to our Vertical Plunger Sinking Pattern illustrated and described on page 7. It was designed to meet the requirements of those who need a sinking pump for prospecting or any situation where a pump of larger capacity is not necessary.

Bulletin 7304.

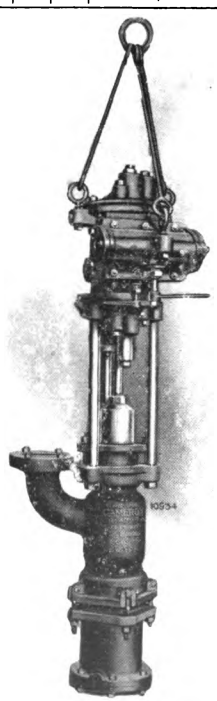
Diameter of Steam Cylinder, Inches	Diameter of Plunger, Inches	Stroke of Piston, Inches	Displacement, Gals. per Min.		Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Space Occupied in Shaft, Inches	Shipping Weight
			Normal	Maximum						
6	3	7	27	~~75~~ 35	¾	1	2	1½	20½x19	810

Contractor's Differential Plunger Pump

The *Cameron* Contractor's Differential Plunger Sinking Pump illustrated, is particularly adapted for situations where the lift is light and the water contains considerable sediment. Lightness is one of the features which is attained by discarding the valve chest and placing the valves in the lower cylinder and plunger. The flow of the water is in one direction, which reduces the frictional resistance and prevents the accumulation of sediment over the valves.

Bulletin 7304.

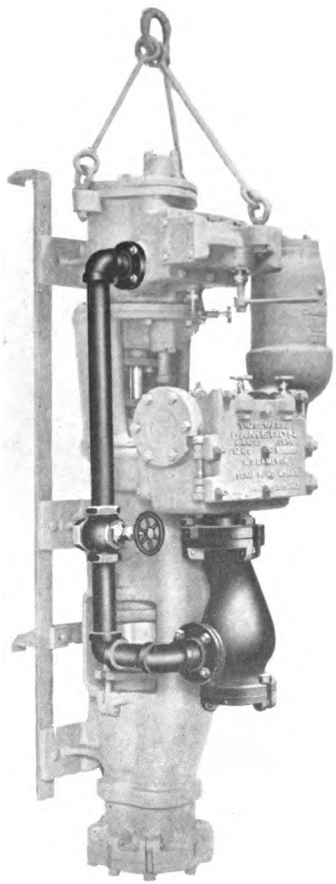
Diameter of Steam Cylinder, Inches	Diameter of Upper Plunger, Inches	Diameter of Lower Plunger, Inches	Stroke of Piston, Inches	Displacement, Gals. per Min.		Steam Pipe, Inches	Exhaust Pipe, Inches	Suction Pipe, Inches	Discharge Pipe, Inches	Shipping Weight
				Normal	Maximum					
6	4	6	7	50	67	¾	1	3	2½	495



Contractor's Differential Type

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Cameron Simplex Direct Acting Pumps



Suction Condenser Attached to Vertical Plunger Sinking Pump

Cameron Suction Condenser

In mines, particularly, it is sometimes a very difficult matter to decide how to dispose of the exhaust steam.

The use of a suction condenser offers a solution of the difficulty. The *Cameron* Suction Condenser has the merit of not presenting any resistance to the free inflow of the water, while at the same time it is exceedingly effective in taking care of the exhaust steam by condensing it and permitting it to enter the pump, as water, through the suction opening, from which it is discharged to the surface. It has also the additional advantage of relieving the steam end of back pressure, as a partial vacuum is formed proportionate to the height of suction lift.

Be sure that the water cylinder is fully charged before the exhaust steam is turned into the condenser by allowing the pump to exhaust into the atmosphere until the pump has become filled with water, when the three-way valve may be turned and the exhaust admitted to condenser.

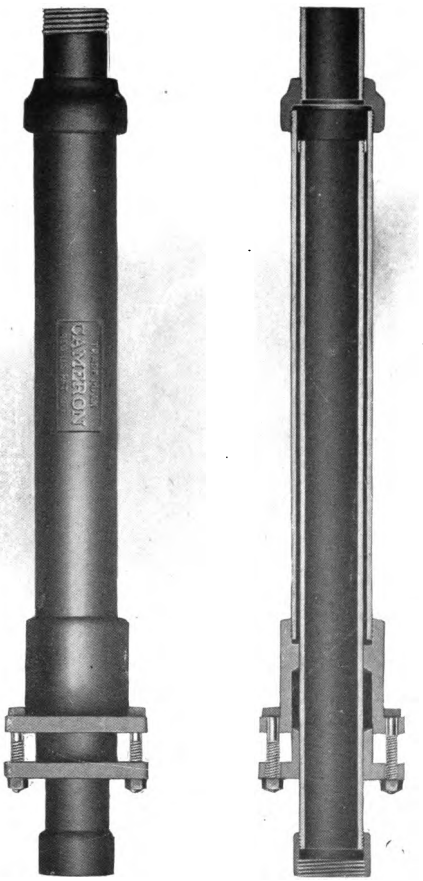
An air leak is fatal to the successful working of this as of any condensing apparatus. The suction condenser and exhaust pipe leading thereto are shown by dark portion on cut herewith.

Bulletin 7304.

Size of Pump	Exhaust Pipe	Suction Pipe	Weight
6 x 3 x 7	1	2	40
8 x 4 x 12	1½	3	100
10 x 5 x 13	2	4	150
12 x 5 x 13	2½	4	150
12 x 7 x 13	2½	5	175
14 x 7 x 13	3	5	200
18 x 9 x 16	4	6	250
16 x 10½ x 16	4	8	580
18 x 10½ x 16	4	8	580

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Cameron Simplex Direct Acting Pumps



Telescopic Joint

Cameron Telescopic Joints

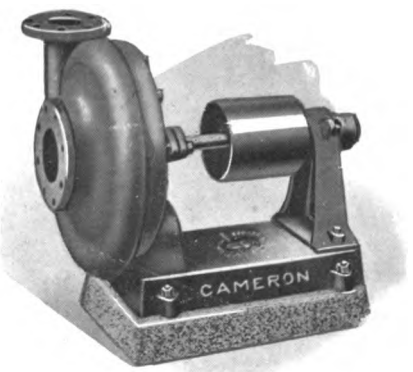
This telescopic joint supplies a convenient means for lifting a pump when blasting, and avoids disconnecting the pipes. We usually make them for sixteen foot travel, to enable the operator to drop the pump that distance without disturbing the rest of the pipe. By its use irregular lengths of pipe may be added, whereas otherwise, when the pump is lowered the pipe would have to be cut in equal lengths. The outside is made of galvanized pipe, and the inside of brass tubing when desired; or with both inside and outside pipes of galvanized iron.

Bulletin 7304.

Diameter of Pipe, Inches	Length of Travel, Feet	Weight
1¼	16	130
1½	16	175
2	16	220
2½	16	300
3	16	400
4	16	500
5	16	600
6	16	885
8	16	1400

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Cameron Centrifugal Pumps



Class "SV" Pump

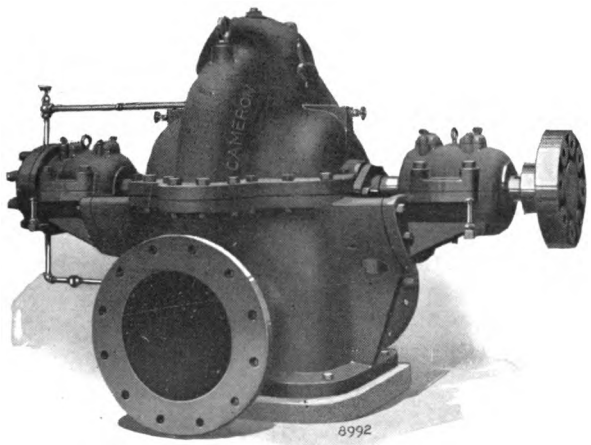
Single suction, open impeller centrifugal pumps, designed especially for low heads. They are very suitable for handling water which contains grit and small solids. Built in capacities from 15 to 6,200 gallons per minute for heads up to 70 feet.

Bulletin 7252

Size Number	Diameter Discharge Inches	Diameter Suction Inches	Shipping Weight Pounds
1	1	1½	100
1½	1½	2	150
2	2	2½	250
2½	2½	3	275
3	3	4	450
4	4	5	550
5	5	6	750
6	6	8	850
8	8	10	1250
10	10	12	1900
12	12	15	2750

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Cameron Centrifugal Pumps



Class "DV" Pumps

Horizontal, single stage, double suction volute, centrifugal pumps arranged for electric motor, steam turbine or other form of direct drive or with pulley for belt drive.

Capacities 125 to 50,000 gallons per minute against heads from 10 to 230 feet.

May be furnished in series arrangement, on one common base extended for receiving driving apparatus either between or at one end of pumps. See page 18.

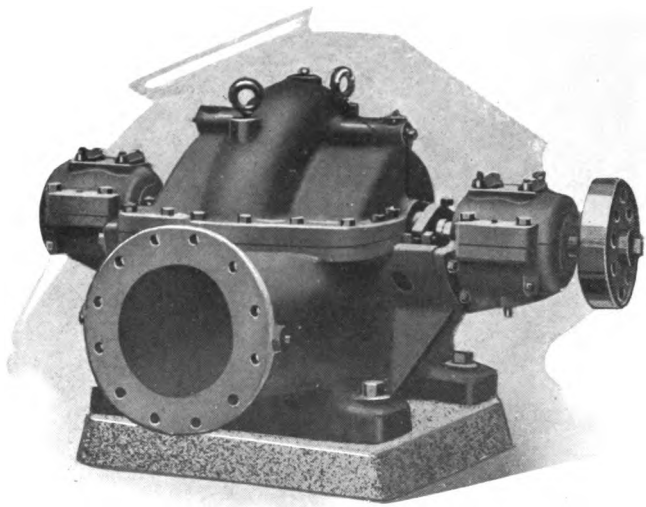
Bulletin 7350

Size Number	Diameter Discharge Inches	Diameter Suction Inches	Approximate Maximum Capacity G.P.M. 15′ Total Suction Lift	Shipping Weight, Lbs.	
				With Bed Plate	Without Bed Plate
2	2	2½	125	650	370
2½	2½	3	200	750	450
3	3	4	300	900	550
4	4	5	450	1150	750
5	5	6	650	1550	1000
6	6	8	1000	2000	1100
8	8	8	1400	2400	1300
10	10	10	2400	2900	1800
12	12	12	4000	4300	2700
14	14	14	6000	5800	3400
16	16	16	8000	7100	4600
18	18	18	10500	8800	6000
20	20	20	14000	12500	7500
24	24	26	20000	20000	12500

Class DV Pumps are manufactured of iron or bronze or a combination of both as specified. Kingsbury Thrust Bearings can be supplied with all pumps from No. 4 to 24, inc.

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Cameron Centrifugal Pumps



Class "FV" Pump

Horizontal, single stage, double suction volute, centrifugal pumps arranged for electric motor, steam turbine or other form of direct drive or with pulley for belt drive.

Capacities from 1250 gallons per minute to 21,000 gallons per minute against heads from 10 to 150 feet.

May be furnished in series arrangement, on one common base extended for receiving driving apparatus either between or at one end of pumps. See page 18.

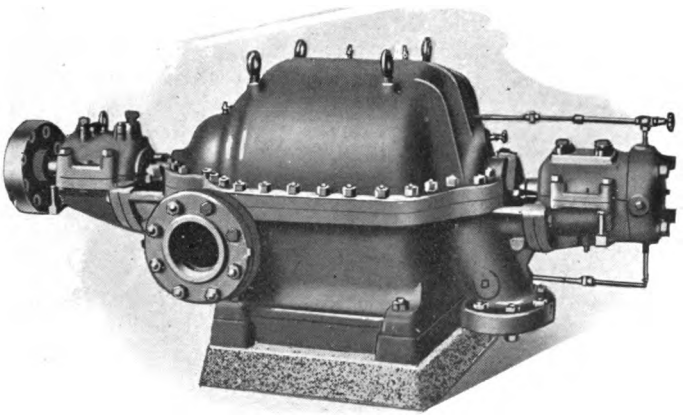
Bulletin 7350

Size Number	Diameter Discharge Inches	Diameter Suction Inches	Approximate Maximum Capacity G.P.M. 15' Total Suction Lift	Shipping Weight, Lbs.	
				With Bed Plate	Without Bed Plate
6	6	6	1250	1900	1100
8	8	8	2250	2300	1300
10	10	10	3500	2900	1800
12	12	12	5000	3900	2800
14	14	14	7000	5400	3500
16	16	16	9000	7100	4800
18	18	18	11200	8800	6000
20	20	20	14500	12500	7500
24	24	26	21000	20000	14000

Class FV Pumps can be manufactured of iron or bronze or a combination of both as specified. Kingsbury Thrust Bearings can be supplied with all FV Pumps.

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Cameron Centrifugal Pumps



Class "ST" Turbine Pump

Horizontal, single suction, multi-stage turbine pumps, arranged for electric motor, steam turbine or other form of direct drive or with pulley for belt drive.

Capacities from 125 gallons per minute to 2400 gallons per minute against heads from 45 to 230 feet per stage. Built in two to five stages inclusive.

May be furnished in series arrangement on one common base extended for receiving driving apparatus either between or at one end of pumps. See page 18.

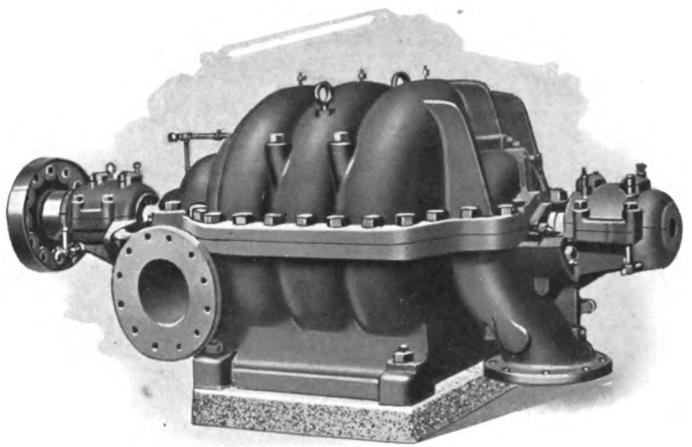
Bulletin 7351.

Size Number	Diameter Discharge Inches	Diameter Suction Inches	Approximate Maximum Capacity G.P.M. 15' Total Suction Lift	Shipping Weight, Lbs.	
				With Bed Plate	Without Bed Plate
2½	2½	3	200	1950	1150
3	3	4	300	2650	1700
4	4	4	425	3100	2100
5	5	5	750	4300	2950
6	6	6	1000	5180	3450
8	8	8	1400	7500	5200
10	10	10	2400	9950	7200

Class ST Pumps can be manufactured of iron or bronze or a combination of both as specified.
Class ST Pumps are furnished with Kingsbury Thrust Bearings or an internal hydraulic balancing device in accordance with the nature of the service.

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Cameron Centrifugal Pumps



Class "MT" Turbine Pump

Horizontal, single suction multi-stage, turbine pumps, arranged for electric motor, steam turbine or other form of direct drive or with pulley for belt drive.

Capacities from 125 to 2400 gallons per minute against heads from 45 to 230 feet per stage. Built in two to five stages inclusively.

May be furnished in series arrangement on one common base extended for receiving driving apparatus either between or at one end of pumps. See page 19.

Bulletin 7351.

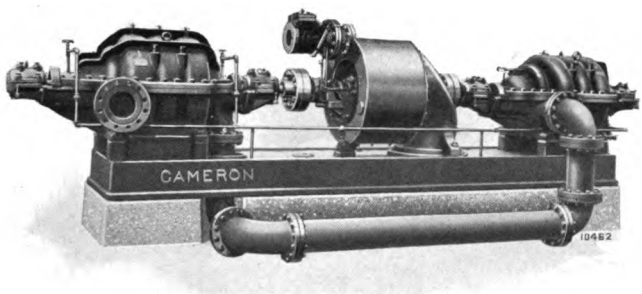
Size Number	Diameter Discharge Inches	Diameter Suction Inches	Approximate Maximum Capacity G.P.M. 15′ Total Suction Lift	Shipping Weight, Lbs. For Direct Connection	
				With Bed Plate	Without Bed Plate
2½	2½	3	200	1450	900
3	3	4	300	1950	1200
4	4	4	425	2350	1400
5	5	5	750	3050	1950
6	6	6	1000	3900	2480
8	8	8	1400	5680	3500
10	10	10	2400	8000	5500

Class MT Pumps can be manufactured of iron or bronze or a combination of both as specified.
Class MT Pumps are furnished with Kingsbury Thrust Bearings or an internal hydraulic balancing device in accordance with the nature of the service.

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Cameron Centrifugal Pumps

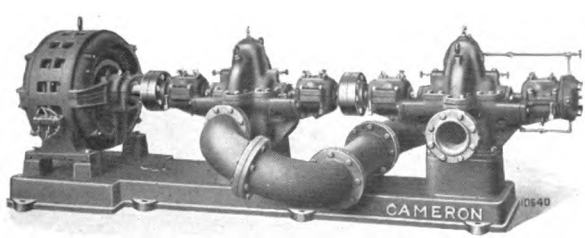
SERIES ARRANGEMENT



CLASS "MT" Four-Stage Turbine Centrifugal Pump in Series—Turbine Driven

Cameron Turbine Centrifugal Pumps are available up to five stages, in a single casing. Where a greater number of stages is necessary to generate the desired head, it is advisable to accomplish this by series arrangement, consisting of two pumps of three, four or five stages each, so arranged that half the pressure is generated by the first group of stages in the first pump, and the remaining pressure by the second group in the second pump. These pumps are arranged to be driven by motor or steam turbine. The series arrangement has the advantage of keeping the shaft distance between the bearings at a reasonable figure, and enables the second pump of the unit to be heavier in construction to withstand the maximum pressure. The number of stages required for a given head is dependent upon the available speed of the driver, the total head and the capacity desired.

Cameron single stage Volute Centrifugal Pumps can also be arranged in series or series parallel giving results not always possible with turbine pumps.



Double Suction Volute Pumps in Series—Motor Driven

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Cameron Pumps

Directions for Ordering

In order that we may be able to answer your inquiry intelligently, and to save time, please inform us as far as possible upon the following points:

What is the liquid to be pumped?

If water, is it hot or cold? Is it pure or does it contain salt, acid, sulphur, sand or grit?

What is the average quantity to be pumped per minute?
What is the maximum that the pump might be called upon to handle?

How high is the liquid to be forced?

What is the actual length of discharge pipe?

If pipe is already laid, what is the diameter and how many turns does it make?

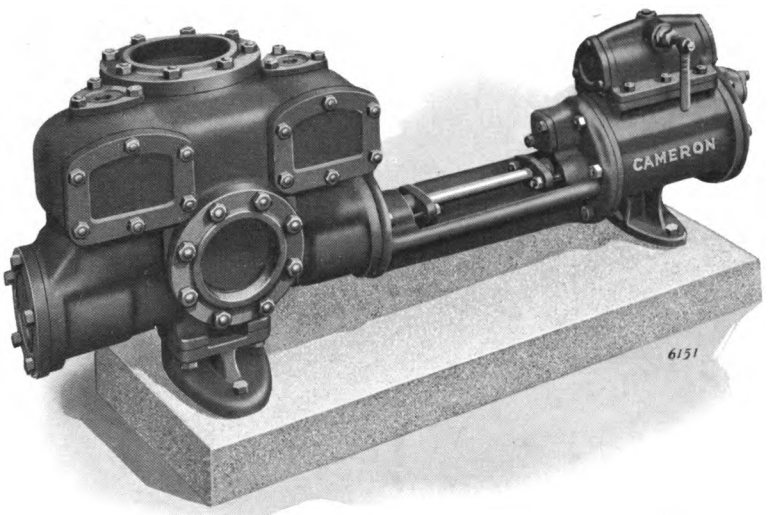
What is the steam pressure at the pump?

Will the pump exhaust into the atmosphere? If against back pressure, how much?

What is the height of suction lift—how far above water will the pump be placed? What is the total length of suction pipe? And how many elbows or turns?

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Cameron Direct Acting Magma Pumps



This pump is suitable for the handling of viscous fluids such as magma, tar, molasses, and the heavy crude oils.

It is of special construction on the pump end with parts of such generous proportion that the fluid to be pumped is afforded unimpeded passage. The discharge valves are bowl shaped and easily reseat themselves when the piston starts in the reverse direction.

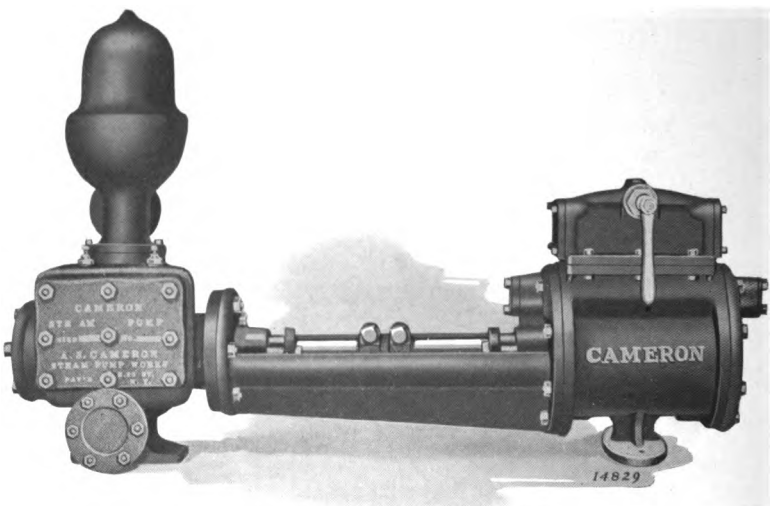
Inlet valves are eliminated by placing the pump below the level of the source of supply thus insuring a constant flow of the fluid into the pump cylinder.

The steam end is of the same standard Cameron construction used on our other direct-acting pumps.

Size	Gallons per Minute	Piston Speed	Steam Pipe Inches	Exhaust Pipe Inches	Suction Pipe Inches	Discharge Pipe Inches	Floor Space
7x6x13	40	43	1	1½	8	6	7'0"x2'0"
10x6x13	40	43	1¼	2	8	6	7'3"x2'0"
12x8x13	70	43	1½	2½	10	8	7'6"x2'6"
14x10x18	130	45	2	3	12	10	9'6"x3'0"

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Cameron Direct Acting Pumps with Combination Rod



In situations where the water end must be packed very tightly, or where the liquid to be pumped is strongly acid, the piston rod is worn down or corroded at one end much more rapidly than on the other. In such cases the ends of the rod become of unequal diameter and the larger end cannot pass through the stuffing box into the water cylinder.

To avoid this, we supply any of our regular piston pumps with an extra long body piece so that the end of the rod which enters the water cylinder never travels into the steam cylinder and vice versa. When so desired, we make the rod in two pieces joined by a clamp, one half of steel and the other of bronze or both ends of either metal. By this arrangement the end which wears more rapidly can be renewed as often as necessary without the expense of replacing the whole rod.

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The Air Lift System of Pumping

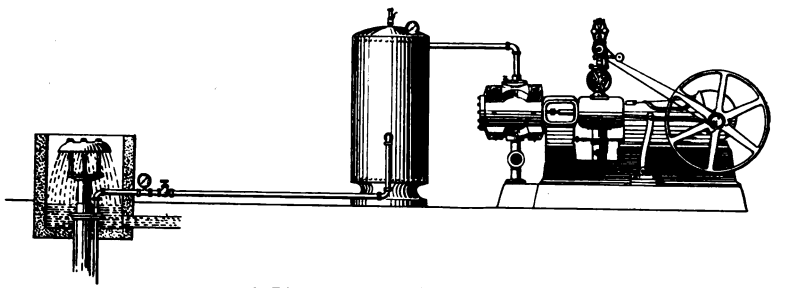


Diagram of Air Lift Plant Operated by Steam Driven Compressor

The Air Lift Pumping System is a method of lifting water, or other fluids by means of Compressed Air without the intervention of valves, cylinders, plungers, or other mechanism. It consists of a discharge, or eduction pipe, extending from a distance below the pumping level of the water to the point of discharge, and an air pipe which is placed either inside or outside of the discharge pipe, and which leads from the main air supply line to a connection near the lower end of the discharge pipe. Compressed Air is forced into the discharge pipe, and mingles with the water, and, as a result, the water rises through the discharge pipe and is discharged from its upper end. The rise of the water in the discharge pipe is due to the energy in a volume of Compressed Air released in the fluid column in the form of bubbles, and the driving force causing the pump to operate continuously is the unbalanced hydrostatic pressure resulting from a mixed column of water and bubbles of air in the discharge pipe of less specific gravity than the outside opposed column of solid water.

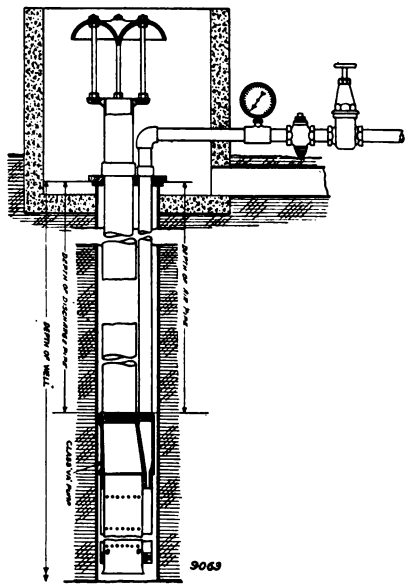
The discharge pipe is generally independent of the well casing, although under certain conditions of strong flow, the well casing itself is used as the discharge pipe. To be operated with efficiency the proper ratio of submergence to lift must be observed, and the correct sizes of pipe used.

One of the greatest fields for the application of this system is in the pumping of drilled wells, in which service its commercial efficiency is higher than any other pumping system. It is also used extensively for unwatering mines; pumping water for irrigation, and for all industrial purposes where a supply of water is required from deep wells. The Air Lift is also extensively used for pumping brine wells; oil wells; and in chemical and manufacturing processes it has been found of peculiar value for lifting acids, solutions, oils, and other fluids and semi-fluids, for which ordinary pumps would not be adapted. This system is also successfully used for handling mill tailings, and for pumping mixtures of sand and water.

The strong features of the Air Lift are that there are no moving parts in the well or source of fluid supply; all machinery needed is contained in the air compressor which is placed in the engine room and operates under best conditions; any number of wells can be pumped from one central plant. See Catalog No. 77.

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The Air Lift System of Pumping



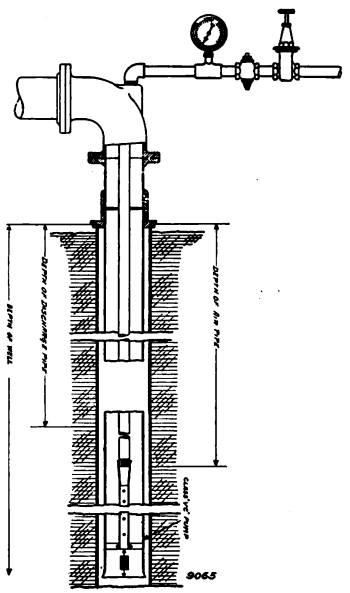
'Imperial" Class "VA" Air Lift Pump

The type "VA" Air Lift Pump is made in the following standard sizes:

Size No.	Smallest Diameter of Well Inches	Pipe Connections		Capacity in Gallons per Minute				Dimensions		Weight
				Per Cent Submergence						
		Discharge Inches	Air Inches	70%	60%	50%	40%	Outside Diameter	Length Overall	
1	4	1½	½	18-37	16-29	12-21	12-19	3½"	6'-5¼"	54
2	5	2	¾	34-65	30-54	22-40	22-35	4¼"	6'-6¼"	69
3	6	2½	1	53-100	46-84	36-60	36-55	5⅛"	6'-7"	88
4	6	3	1	90-130	80-120	60-105	60-95	5½"	6'-8¼"	106
5	6	3½	1	130-250	115-180	90-150	90-130	5⅞"	6'-8⅞"	110
6	8	4	1¼	180-325	160-250	125-200	125-180	7⅛"	6'-9½"	146
7	8	4½	1½	240-480	210-375	160-280	160-250	7⅞"	6'-10¼"	169
8	10	5	1½	300-600	270-475	210-360	210-300	8¾"	6'-10⅞"	213
9	10	6	1½	500-900	425-775	340-575	340-500	9¾"	6'-11¼"	254

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The Air Lift System of Pumping



"Imperial" Class "VC" Air Lift Pumps

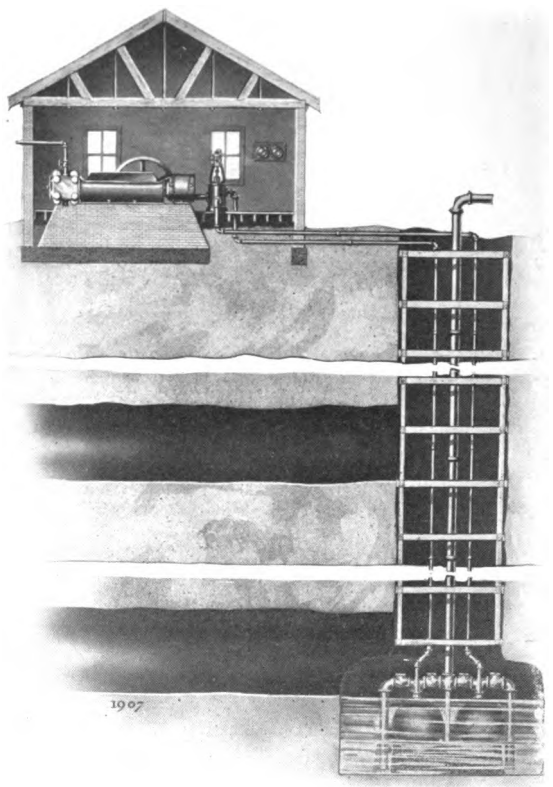
The type "VC" Air Lift Pump is made in the following standard sizes:

Size No.	*Smallest Diameter of Well Inches	Pipe Connections		Capacity in Gallons per Minute				Weight
		Standard Diameter Discharge Pipe Inches	Size Air Pipe Inches	Submergence Per Cent				
				70%	60%	50%	40%	
1	4	2	½	28-54	25-45	18-33	18-29	58
2	4½	2½	¾	47-88	40-74	32-53	32-48	76
3	5	3	1	73-105	65-98	50-85	50-77	94
4	5½	3½	1	110-210	100-155	77-130	75-110	108
5	6	4	1¼	150-270	135-200	105-165	105-150	125
6	7	4½	1½	200-400	175-305	135-230	135-200	148
7	8	5	1½	260-500	230-400	180-300	180-250	187
8	9	6	1½	450-800	380-700	300-500	300-450	225
9	10	7	2	500-1000	450-850	375-700	350-575	245
10	11	8	2	800-1250	750-1250	650-1000	500-750	334
11	13	10	2½	1200-2000	1000-1800	850-1650	700-1300	467

*NOTE:—When the well casing must serve as the discharge pipe, and the outer tube of the VC Pump be omitted, the inner brass tube can be used in a well of the same inside diameter as the standard discharge pipe listed in the next column.

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The "Return-Air" Pumping System



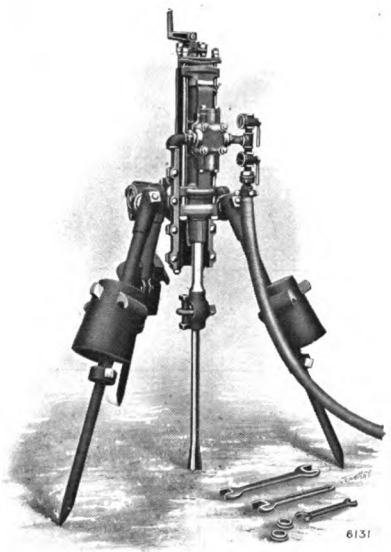
The "Return-Air" Pumping System is a device for moving or lifting volumes of water or other fluids or semi-fluids by means of direct displacement with a volume of compressed air. It differs from the ordinary displacement pump in that the air is not exhausted after displacement, but is returned to the compressor intake. As a result of this operation in a closed circuit, the "Return-Air" System has a higher economy than any other displacement system. There is no mechanism in contact with the material pumped and the system will handle any substance sufficiently fluid to pass its valves. Applications of the "Return-Air" System are found in pumping water, sewage, glass sand, pulp, marl, cement slurry, concentrator slimes, etc. It is especially adapted for use as a station pump in mines.

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The "Sergeant" Type Rock Drill



The "Sergeant" Drill

The "Sergeant" Drill is to-day the most powerful, reliable and effective independent valve piston type of rock drill on the market and the most economical in the matter of repairs and air or steam consumption.

One of the principal features is the Sergeant Auxiliary Valve Motion, whereby an independent air-thrown valve of the spool type is controlled by an auxiliary valve which in turn is operated by the piston.

The "Sergeant" may be run on a very short stroke—the stroke being regulated by merely "cranking" the drill toward or away from the rock.

The "Sergeant" is especially adapted to drilling operations in quarries, contracting work, and railroad construction where steam is used as the motive power and the holes are deep. However, it is much more efficient and easily handled when operated by compressed air.

It may be mounted on tripod, bar or column. Bulletin 4302

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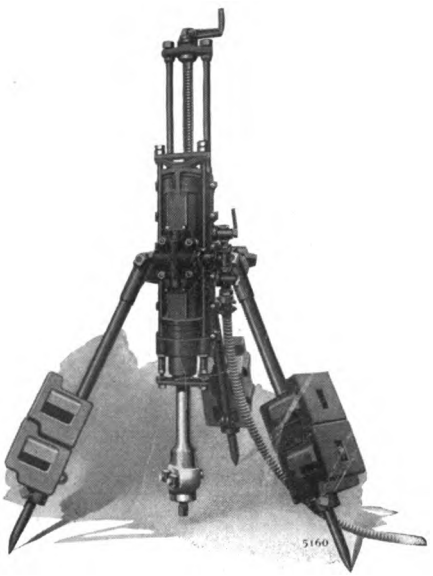
Descriptive Table of "Sergeant" Rock Drills---(24 Type)

Symbol indicating size and type	A 86	B 24	C 24	D 24	D 44	E 24	E 44	F 24	F 194
DIMENSIONS:									
Diameter of Cylinder ... in.	2¼	2½	2¾	3	3	3¼	3¼	3½	3⅝
Length of Stroke ... in.	5	6	6½	6½	6½	6½	6½	7	7½
Length of drill from end of crank to end of piston ... in.	37	41	48	48½	48½	49	49	52	52½
Depth of hole drilled without change of bit ... in	15	20	24	24	24	24	24	24	24
Diameter of supply inlet (standard pipe) ... in.	¾	¾	1	1	1	1	1	1	1
Approximate strokes per minute with 75 lbs. pressure at drill ...	500	500	375	350	350	350	350	300	300
Depth of vertical hole each machine will drill easily from 1 to ... ft.	6	8	10	14	14	16	16	20	20
Diameter of holes drilled as desired, from ... in.	¾ to 1½	1 to 1½	1¼ to 2¼	1½ to 2¼	1½ to 2¼	1¾ to 2¾	1¾ to 2¾	1¾ to 3	1¾ to 3
Diameter of octagon steel used ... in.	⅞ or ¾	1 and ⅞	1⅛ and 1	1¼ and 1⅛	1¼ and 1⅛	1¼ and 1⅛	1¼ and 1⅛	1⅜ and 1¼	1⅜ and 1¼
Size of shanks (diameter and length) ... in.	⅞ x 5	⅞ x 5	1 x 5½	1⅛ x 6	1⅛ x 6	1⅛ x 6	1⅛ x 6	1¼ x 6	1¼ x 6
Number of pieces in set of steels to drill holes to depths, as stated ...	5	5	5	7	7	8	8	10	10
Best size of boiler to give plenty of steam at high pressure ...	6 H P	8 H P	8 H P	8 H P	8 H P	10 H P	10 H P	10 H P	10 H P
Best size of supply pipe to carry steam 100 to 200 feet ... in.	¾	1	1	1	1	1	1	1¼	1¼
APPROXIMATE WEIGHTS:									
Drill unmounted, not boxed ... lbs.	135	185	265	275	300	285	330	400	410
Drill, unmounted, with wrenches and fittings, boxed ... lbs.	170	235	320	330	355	345	390	465	470
SHIPPING MEASUREMENTS (over all):									
Box with unmounted drill and fittings ... ft. in.	36 10 010	310 12 10	46 12 011	46 12 011	46 12 011	46 12 011	46 12 011	48 15 10	48 15 10
Box with one length of hose ... ft. in.	28 28 06	28 28 06	210 28 06	210 28 06	210 28 06	210 28 06	210 28 06	210 28 06	210 28 06

Note:—DRILL COMPLETE includes drill, throttle, oiler and wrenches, and does not include mounting, steels, hose or blacksmith's tools.

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Deep Hole Rock Drills



Ingersoll-Rand Deep Hole Rock Drills are especially adapted for quarry work requiring deep holes, submarine drilling from platforms and similar classes of work.

The G-108 is of the well-known Sergeant Auxiliary Valve type while the H-9 is controlled by the Ingersoll exhaust thrown spool valve.

Because of the severe work and frequently unfavorable working conditions, these have been made exceptionally simple and rugged. They will give satisfactory service for a longer period of time. Further information on request.

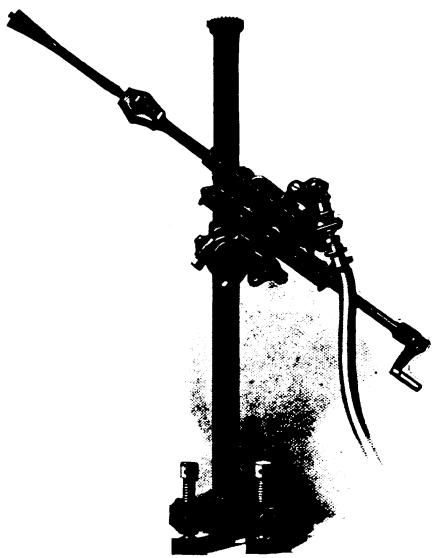
Type of Drills	New Ingersoll	Sergeant
Symbols of Drills indicating Size and Type	H-9	G-108
Cylinder Diameter, inches	5½	4¼
Piston Stroke, inches	8	8
Length of Feed, Feet	2½	3
Length of Drill from end of Crank to end of Piston, inches	60	58
Diameter of Supply Inlet (Standard Pipe) inches	1¼	1¼
Approximate Strokes per min. (75 lbs. Pressure at Drill)	250	400
Greatest Depth of Hole each Machine will drill easily, feet	32	27
Diameters of Holes Drilled, inches	3 to 6	3 to 6
Diameters of Octagon Steel Used, inches	1¾	1¾ & 1½
Sizes of Shanks (Diameters and Lengths) inches	1¾ x 7	1¾ x 7
Best size of boiler to give plenty of steam at High Pressure, H. P.	25	18
Approximate Weights, Drill Unmounted, with Wrenches and Fittings, not boxed, Pounds	930	605
Approximate Weights, Drill, Unmounted, with Wrenches and Fittings, boxed, Pounds	1170	725
Shipping Measurements Overall, Box with Unmounted Drill and Fittings, Feet and Inches	5′2″x2′2″x1′5″	4′8″x1′5″x1′3″

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The "Butterfly" Type Rock Drill

The "Butterfly" Rock Drill is an extremely light weight and high speed piston type rock drill. This was made possible by new designs, the use of IRCO metal for the cylinder and important parts, and the "Butterfly" valve action.

The "Butterfly" valve is very simple, consisting of a central trunion with wings extending on both sides. The valve does not slide but swings, with a very short lift, on the trunion, opening and closing both inlet and exhaust ports. There are no other moving parts in the valve chest. This valve motion is non-freezing.



The "Butterfly" Drill

The field of this drill is similar to that of the smaller sizes of "Sergeant" drills.

The "Butterfly" Drill operates on compressed air only. Bulletin 4105.

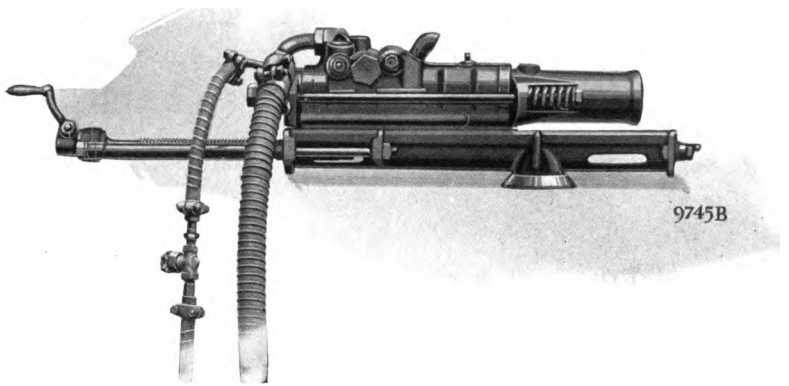
Symbol indicating Size and Type		C110	C113	D110	D113
Diameter of Cylinder		2¾"	2¾"	3⅛"	3⅛"
Length of Stroke		6¼"	6¼"	6¼"	6¼"
Length of Drill from end of crank to end of piston		41"	41"	41"	41"
Depth of hole drilled without change of steel		24"	24"	24"	24"
Diameter of supply inlet		¾"	¾"	¾"	¾"
Approximate strokes per minute with 70 lbs. air pressure		600	600	550	550
Depth of Vertical hole drilled easily from 1 ft. to		8	8	10	10
Diameter of holes drilled		1⅜" to 2¼"	1⅜" to 2¼"	1⅜" to 2¼"	1⅜" to 2¼"
Size of Octagon Steel used		1" to 1⅛"	1" to 1⅛"	1" to 1⅛"	1" to 1⅛"
Number of Pieces in Set of Steel		4	4	5	5
List Size of Supply Pipe to carry air 100 to 200 ft		1	1	1	1
Approximate Weight					
Drill mounted with wrenches and fittings not boxed		137 lbs.	140 lbs.	235 lbs.	208 lbs.
Drill mounted with wrenches and fittings—boxed		180 lbs.	185 lbs.	240 lbs.	240 lbs.
Shipping Measurements (over all)					
Box with unmounted Drill and Fittings	Length	3'10"	3'10"	3'10"	3'10"
	Width	1'2"	1'2"	1'2"	1'2"
	Height	0'9"	0'9"	0'9"	0'9"
Box with one length of hose	Length	2'10"	2'10"	2'10"	2'10"
	Width	2'8"	2'8"	2'8"	2'8"
	Height	0'6"	0'6"	0'6"	0'6"

Note:—DRILL COMPLETE includes drill, throttle, oiler and wrenches, and does not include mounting, steels, hose or blacksmith's tools.

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Leyner-Ingersoll Drifters

MODELS 148, 248 and 448



No. 248 Drifter

These mounted hammer type drifting drills have gained an enviable reputation for fast drilling with a minimum of upkeep cost and time lost for repairs. They are the standard drills of many of the largest mines and tunnels of the world.

The patented Ingersoll-Rand exhaust-relief valve makes successful utilization of the expansion of the compressed air possible, hence, these drills are very efficient.

The parts are principally drop forgings. The material is carefully selected and heat-treated to give the very best result. All parts are made strictly interchangeable, assuring exact fit of replacement parts.

These drills have all the most modern improvements.

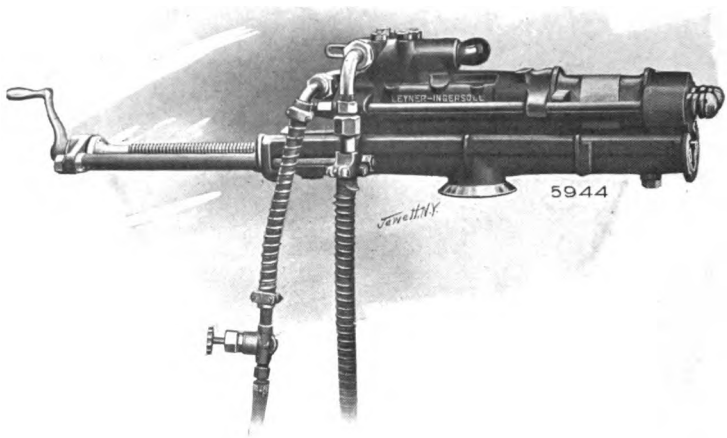
The standard machines are equipped for I-R lug shank. If desired, however, they can be furnished with anvil-block chucks to accommodate shankless steels. Bulletin 4308.

	No. 148	No. 248	No. 448
Weight Drill only, 24″ feed (Standard)	148 lbs.	156 lbs.	156 lbs.
Length overall 24″ feed (Standard)	48¾ ins.	47¾ ins.	47¾ ins.
Weight Drill only, 30″ feed (Special)		168 lbs.	168 lbs.
Length overall 30″ feed (Special)		53⅝ ins.	53⅝ ins.
Size of cone	5 ins.	5 ins.	5 ins.
Size of Air Hose	1 in.	1 in.	1 in.
Size of Water Hose	½ in.	½ in.	½ in.
Standard Hollow Drill Steel with Leyner Shank	1¼ in. Round	1¼ in. Round	1¼ in. Round
Standard Hollow Hexagon Steel for Anvil Block Chuck	1 in.	1 in.	1 in.
Most economical depth to which holes can be drilled	8 to 12 ft.	8 to 12 ft.	8 to 12 ft.

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Leyner-Ingersoll Drifters

MODELS 18 AND 26



No. 18 Drifter

These hammer type drills embody a number of very desirable features, such as the "Butterfly" Valve, Automatic Lubrication, Automatic Rotation, Water Feed and Chuck for all type of Hollow Steel.

The most distinctive of them all is the Water Attachment by means of which combined a stream of water and air is forced to the bottom of the drill hole, through hollow drill steel, effectively removing the cuttings, greatly increasing the drilling speed and abating the dust nuisance.

It is a rapid drilling machine, light in weight and easily handled. It is used with any of the standard styles of mountings and finds its application in the rapid and economical driving of tunnels, drifts and the general run of mine work.

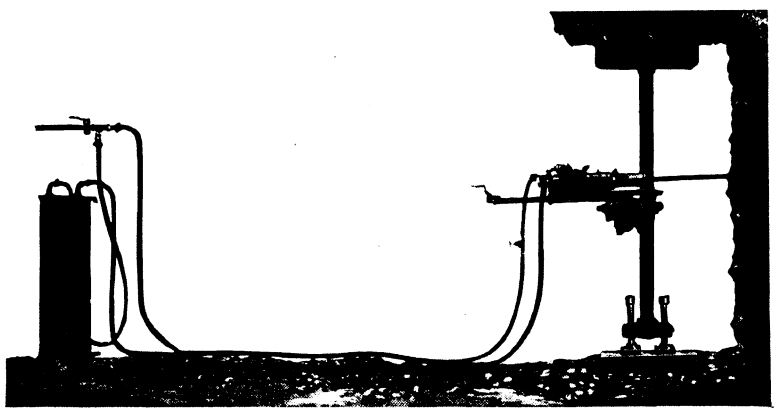
Because of its Butterfly Valve it is especially recommended where only low air pressures are available. If pressures of 70 lbs. or above can be had the number 148 or 248 drills shown on the preceding page are recommended.

Bulletin 4120.

Description	No. 18	No. 26
Weight Drill only, 20″ feed (Standard)		95 lbs.
Length over all 20″ feed		40 ins.
Weight Drill only, 24″ feed (Standard)	150 lbs.	
Length overall 24″ feed	47¾ ins.	
Weight Drill only, 30″ feed	160 lbs.	114 lbs.
Length over all 30″ feed	53¾ ins.	40 ins.
Size of cone	5 ins.	5 ins.
Bore of Cylinder	2½ ins.	2¼ ins.
Length of Stroke	3 ins.	2½ ins.
Size of Air Hose	¾ in.	¾ in.
Size of Water Hose	½ in.	½ in.
Standard Hollow Drill Steel and Shank	1¼ in. Round	⅞ in. Hex.
Most economical depth to which holes can be drilled	8 to 12 ft.	6 to 9 ft.

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Water Feeding Arrangement for Ingersoll-Rand and Leyner-Ingersoll Drills



This is the water feeding arrangement furnished for the Leyner-Ingersoll Drifters, Wet Jackhamers and Wet Stopehamers.

Compressed air is admitted to the tank, and this forces the water to the drills under the same pressure as the air used to operate the drills, if taken from the same air line. The air which is admitted to the water tank is not the air which combines with the water and cleans the drill holes. This air comes from the drills.

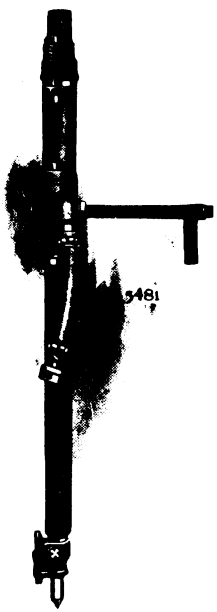
The water is carried from the water pipe line, or from the tank through a small water hose about 50 feet in length, then through a water regulating valve and a short piece of hose to the backhead of the drill. The water passes through the backhead plug and water tube, into the shank of the drill steel, where air from the drill mingles with it, and both pass on through the drill steel to the bottom of the drill hole laying the dust and blowing the rock chips from the cutting face.

The tanks have a capacity of 18 gallons, but smaller tanks with a capacity of 6 gallons can be furnished if desired.

Bulletins 4122 and 4038.

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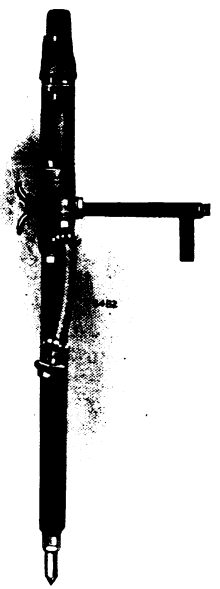
Stopehamers



BC-20 Stopehamer
(Extension Feed)



BCW-22 Stopehamer
(Reverse Feed)



BC-21 Stopehamer
(Plain Feed)

The "Stopehamer" is the standard type of machine for the drilling of holes from 20 degs. above the horizontal to vertically upward.

There are twenty patterns of "Stopehamers"; wet or dry; plain, extension, or reverse air-feed; light or medium weight; valve-controlled or valveless.

The "BC" type is equipped with "Butterfly" valve and is preferred where medium pressures (about 70 lbs. only) are available. The "CC" type is equipped with a differential piston and an exhaust relief valve. It is superior to any drills of its type on the market on pressures higher than 70 lbs.

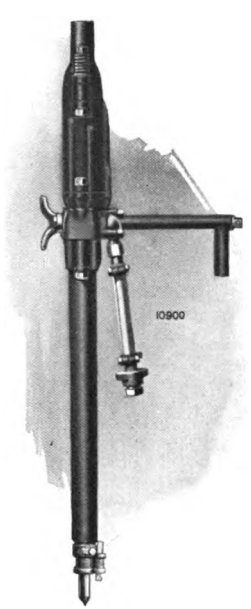
The "CA" type is similar in all respects (except size) to the "CC" type. This drill fills the demand for an exceptionally light machine.

The general features of construction applying to all types are; All Steel Construction; Renewable Anvil Block Bearing; Single Throttle Control; Heart-Beat Lubrication; Extra Long Chuck, Spring Retained Front-head.

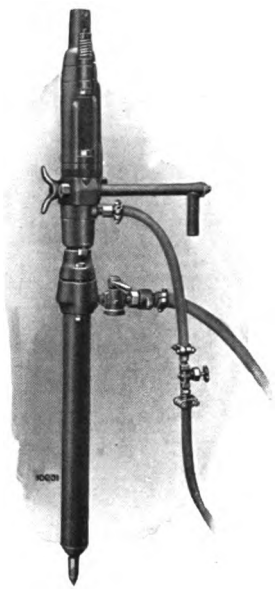
Bulletins 4311 and 4236.

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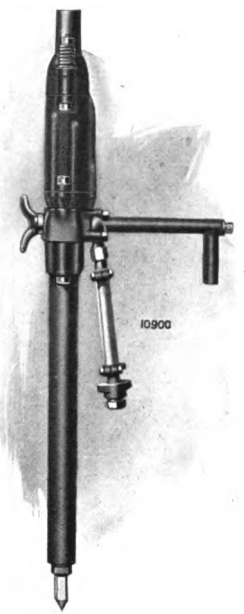
Stopehamers



CC-10 Stopehamer (Extension Feed)



CCW-12 Stopehamer (Reverse Feed)



CC-11 Stopehamer (Plain Feed)

AIR FEEDS FOR STOPEHAMERS

The "0" type (extension feed) is used where the conditions are such that the distance from the floor to the roof is continually varying. It is fitted with an extension pointer, which can be adjusted to meet these conditions and saves time otherwise spent in blocking up machine.

The "1" type (plain) is recommended for general work. It is the simplest form of air feed and differs from the "0" type in having a plain feed piston rod without an extension leg.

The "2" type (reverse) is a reversed feed and is used when the machine is to be mounted on a column or tripod. In this type the feed piston rod is attached directly to the machine, which allows the feed piston and machine to feed forward when the feed cylinder is clamped in a mounting position.

The standard diameter of feed is 2¼ in.

The type number is the last number in the symbol of the Stopehamer; e. g., CC-21 indicates a Type CC-2 Stopehamer with a Type 1 (Plain) Air Feed.

See tables of essential details on page 10.

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Stopehamers

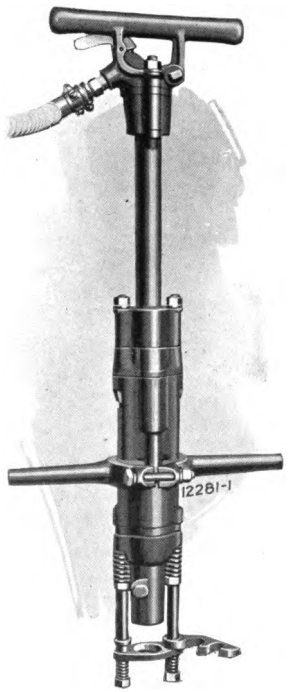
	BC20	BC21	BCW21	BC21-W-2	BC22	BCW22	BC22-W-2
Bore of Hammer Cylinder	2″	2″	2″	2″	2″	2″	2″
Length of Stroke	4″	4″	4″	4″	4″	4″	4″
Travel of Air Feed	22″	22″	22″	22″	22″	22″	22″
Travel of Extension Pointer	24″						
Length of Drill (Feed Closed)	55½″	52½″	53¾″	54½″	56½″	58″	58½″
Length of Drill (Feed Extended)	77½″	74½″	75¾″	76½″	58½″	80″	80½″
Length of Drill (Feed Extended and pointer run out)	101½″						
Diam. of Air Feed (Pressure 70 lbs. or over)	2⅛″	2⅛″	2⅛″	2⅛″	2⅛″	2⅛″	2⅛″
Diam. of Air Feed (Pressure under 70 lbs.)	2¼″	2¼″			2¼″	2¼″	
Size of Inlet	¾″	¾″	¾″	¾″	¾″	¾″	¾″
Size of Hose	¾″	¾″	¾″	¾″	¾″	¾″	¾″
Steels (No Collars required)	Solid 7/8″ Hex. 1″ Cruc.	Solid 7/8″ Hex. 1″ Cruc.	Hollow 1″ Hex.	Hollow 1″ Hex.	Solid 7/8″ Hex. 1″ Cruc.	Hollow 1″ Hex.	Hollow 1″ Hex.
Weight	81 lbs.	73 lbs.	73½ lbs.	80½ lbs.	84 lbs.	90 lbs.	91½ lbs.
Weight of Drill and Equipment Boxed	125 lbs.	115 lbs.	115 lbs.	120 lbs.	125 lbs.	132 lbs.	145 lbs.

	CA21	CAW21	CC10	CCW10	CC11	CCW11	CC12	CCW12
Bore of Hammer Cylinder....in.	1⅛x2¼	1⅛x2¼	1⅛x2¾	1⅛x2¾	1⅛x2¾	1¼x2¾	1⅛x2¾	1⅛x2¾
Length of Stroke	3¼″	3¼″	3″	3″	3″	3″	3″	3″
Travel of Air Feed	22½″	22½″	22″	22″	22″	22″	22″	22″
Travel of Extension Pointer			24″	24″				
Length of Drill (Feed Closed)	49½″	49½″	55″	57″	52″	54″	56″	58″
Length of Drill (Feed Extended)	72″	72″	77″	79″	74″	76″	78″	80″
Length of Drill (Feed Extended and pointer run out)			101″	103″				
Diam. of Air Feed (Pressure 70 lbs. or over)	2″	2″	2¼″	2¼″	2¼″	2¼″	2¼″	2¼″
Diam. of Air Feed (Pressure under 70 lbs.)	2″	2″	2⅜″	2⅜″	2⅜″	2⅜″	2⅜″	2⅜″
Size of Inlet	½″	½″	¾″	¾″	¾″	¾″	¾″	¾″
Size of Hose	¾″	¾″	¾″	¾″	¾″	¾″	¾″	¾″
Steels (No Collars required)	Solid 1″&7/8″ Hex. 1″ Cruc.	Hollow 1″&7/8″ Hex.	Solid 1″ Hex. 1⅛″ Cruc.	Hollow 1″ Hex.	Solid 1″ Hex. 1⅛″ Cruc.	Hollow 1″ Hex.	Solid 1″ Hex. 1⅛″ Cruc.	Hollow 1″ Hex.
Weight	57 lbs.	60 lbs.	88 lbs.	95 lbs.	81 lbs.	88 lbs.	91 lbs.	98 lbs.
Weight of Drill and Equipment Boxed	85 lbs.	90 lbs.	131 lbs.	139 lbs.	123 lbs.	131 lbs.	134 lbs.	142 lbs.

	CC-20	CCW-20	CC-21	CCW-21	CC-22	CCW-22
Bore of Hammer Cylinder	1⅜″x2¾″	1⅜″x2¾″	1⅜″x2¾″	1⅜″x2¾″	1⅜″x2¾″	1⅜″x2¾″
Length of Stroke	4″	4″	4″	4″	4″	4″
Travel of Air Feed	22″	22″	22″	22″	22″	22″
Travel of Extension Pointer	24″	24″				
Length of Drill (Feed Closed)	55″	57″	55½″	57″	56″	58″
Length of Drill (Feed Extended)	77″	79″	77½″	79″	78″	80″
Length of Drill (Feed Extended and pointer run out)	101″	103″				
Diam. of Air Feed (Pressure 70 lbs. or over)	2⅜″	2⅜″	2⅜″	2⅜″	2⅜″	2⅜″
Diam. of Air Feed (Pressure under 70 lbs.)	2⅜″	2⅜″	2⅜″	2⅜″	2⅜″	2⅜″
Size of Inlet	¾″	¾″	¾″	¾″	¾″	¾″
Size of Hose	¾″	¾″	¾″	¾″	¾″	¾″
Steels (No Collars required)	Solid 1″ Hex. 1⅛″ Cruc.	Hollow 1″ Hex.	Solid 1″ Hex. 1⅛″ Cruc.	Hollow 1″ Hex.	Solid 1″ Hex. 1⅛″ Cruc.	Hollow 1″ Hex.
Weight	97 lbs.	104 lbs.	90 lbs.	100 lbs.	100 lbs.	107 lbs.
Weight of Drill and Equipment Boxed	146 lbs.	155 lbs.	135 lbs.	145 lbs.	150 lbs.	160 lbs.

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Pneumatic Clinker Breaker Type "CC-27"



Type "CC" Clinker Breaker

The "Clinker breaker" is a compressed air operated tool for rapidly, efficiently and economically breaking down for removal the hard clinkers formed in gas generators.

The "Clinker breaker" delivers many hundreds of forceful blows per minute to the steel. This will break down the hardest clinker so that the fires may be run to obtain the maximum gas output.

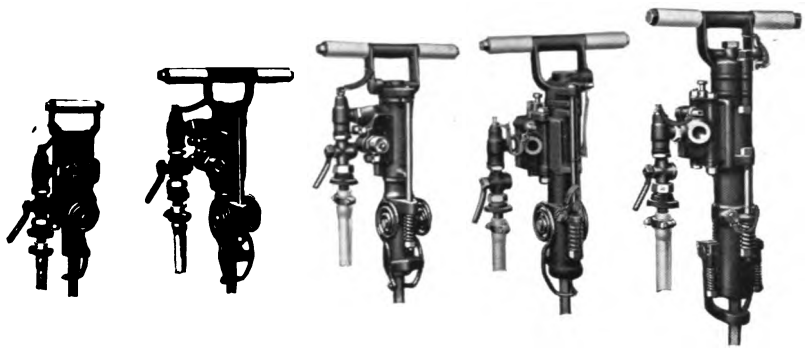
The removal of the clinker can be absolutely controlled. This prevents the fire from dropping prematurely, thus saving fuel.

Bulletin in preparation.

Weight, without steel	85 lbs.
Length over all	48 5/8"
Bore of cylinder	1 3/8" x 2 3/4"
Length of stroke	4"
Size of air inlet	3/4"
Size of hose	3/4"

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Dry Jackhamers



BAR-33 BBR-13 BCR-430 DCR-13 DDR-13

The "Jackhamer" has been developed in a large variety of sizes and types, each suited to a particular class of work.

The "Jackhamer" is the superior drill of the hand hammer type. The distinctive features are; all steel drop forge construction, automatic rotation, spring held fronthead, steel holder, automatic lubrication, efficient dust blowing device and "Butterfly" valve. The "Butterfly" valve is used on all types except the "DCR" and "DDR" which uses a spool valve operating on the "Butterfly" principle.

Type "BAR-33" is for general light drilling in soft or medium rock or concrete to a depth of 4 ft., very useful in industrial plants.

Type "BBR-13" and "BBR-130" is principally used with twisted auger steel in coal and soft iron ores.

Type "BCR-430" is designed to meet the greater majority of hand hammer drill work. It will drill to 9 ft. in hard rock. Furnished in wet or dry patterns.

Type "DCR-13" is designed for shaft sinking in average rock or for work requiring a slightly heavier drill than the "BCR-430". Furnished in wet or dry patterns.

Type "DDR-13" is built for the heaviest and roughest hand hammer drill service. It will drill to over 12 ft. deep in the hardest rock and is the fastest drill of its kind on the market.

The last three types can be operated by either compressed air or steam, but any rock drill operated by steam is only about 50 per cent as efficient as when operated by compressed air.

Bulletins No. 4043, 4131, 4321, 4048 and 4141.

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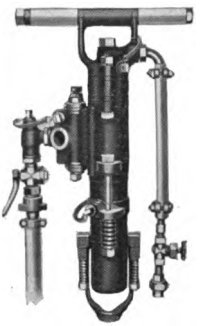
Wet Jackhamers



BCRW-430



DCRW-13



DDRW-13

The "BCR", "DCR" and "DDR" Jackhamers can very readily be converted to water machines by adding a few new parts. The two smaller sizes ("BAR" and "BBR") are not available in wet types.

The above "Jackhamers" are of the "wet" or "water feeding" type. They are identical in all respects to the dry types except for the addition of the water feed parts. For example, the "BCRW-430" is the same as the "BCR-430" plus a water feeding device.

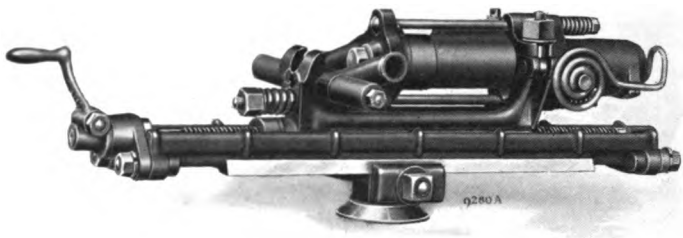
This device is of the well-known "Leyner" design. Water is passed through the backhead and water tube. Then, as it enters the hollow drill steel, it is mixed with air under pressure. This allays the dust which is a discomfort and is often injurious to the operator. It also removes the rock particles from the cutting face of the drill bit, permitting each blow to do effective work and eliminating the wasting of energy in further pulverizing ground already cut.

The cooling of the steel by the water has also been found beneficial in maintaining the temper of the bit.

	BAR33	BBR13	BCR430	BCRW430	DCR13	DCRW13	DDR13	DDRW13
Bore of Hammer Cylinder...	2⅜"	2⅜"	2¼"	2¼"	2⅜"	2⅜"	2⅝"	2⅝"
Length of Stroke.....	1½"	1⅞"	2"	2"	2½"	2½"	3"	3"
Length of Drill.....	15¼"	18"	19½"	19½"	21¼"	21¼"	25"	25"
Size of Inlet.....	½"	½"	½"	½"	½"	½"	¾"	¾"
Size of Hose.....	½"	¾"	¾"	¾"	¾"	¾"	¾"	¾"
Steel.....	Hollow ⅞" Hex. Shank ⅞"x3¼"	Hollow ⅞" Hex. Shank ⅞"x3¼"	Hollow ⅞" Hex. Shank ⅞"x3¼"	Hollow ⅞" Hex. Shank ⅞"x3¼"	Hollow ⅞" Hex. Shank ⅞"x3¼"	Hollow ⅞" Hex. Shank ⅞"x3¼"	Hollow 1" Hex. Shank 1"x4¼"	Hollow 1" Hex. Shank 1"x4¼"
Weight.....	21½ lbs.	36 lbs.	41 lbs.	41 lbs.	55 lbs.	55 lbs.	70 lbs.	70 lbs.
Weight of drill and equipment boxed.....	36 lbs.	48 lbs.	60 lbs.	60 lbs.	78 lbs.	78 lbs.	110 lbs.	110 lbs.

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Jackhamer Mountings



"JC-10" Jackhamer Mounting

The "JC-10" Mounting is built to accommodate the "BCR-430" and "BCRW-430" Jackhamers; the "JC-11" mounting for the "DCR-13" and "DCRW-13" Jackhamers; and the "JD-10" mounting for the "DDR-13" and "DDRW-13" Jackhamers.

The "Jackhamer" mounting is adapted for use either on the arm of a column, horizontal shaft bar or on a tripod.

This is a thoroughly practical outfit for flat hole work, such as drifting, or underhand stoping in metal mines, breaking down coal, and driving gangways in coal mines. The drill can therefore, be used for a twofold purpose; mounted for drilling flat holes in the heading and unmounted for drilling down holes in the bench.

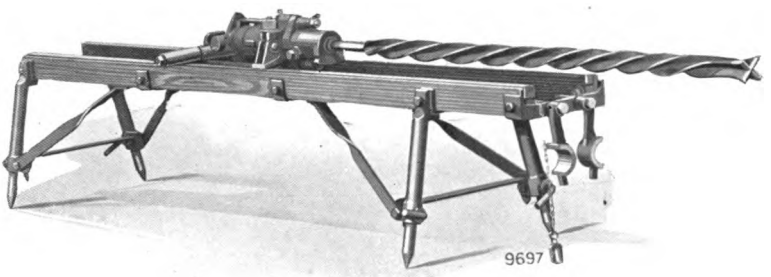
Bulletin 4044.

	JC-10	JC-11	JD-10
Weight of Mounting	69 lbs.	70 lbs.	70 lbs.
Weight with Jackhamer complete	116 lbs.	126 lbs.	143 lbs.
Length	39 in.	39 in.	39 in.
Height	10¾ in.	10⅞ in.	11⅛ in.
Distance from bottom of cone to center of Jackhamer	8 in.	8 in.	8 in.
Feed—using ⅞" Hex. J. H. shanks	20 in.	20 in.	20 in.
Max. movement of sliding cone	19 in.	19 in.	19 in.

The standard 3" S. S. Column is suitable for use with the Jackhamer Mountings.

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Jackhamer Mountings



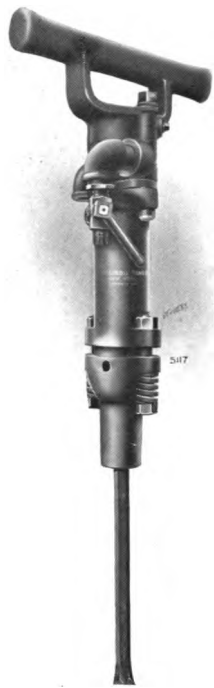
The "JC-40" Mounting will accommodate the standard "BCR" or "BBR" Jackhamer, either wet or dry patterns. It merely acts as guide for the drill, pointing it in the desired direction and holding it in alignment while drilling. It is particularly advantageous in very narrow seams, found extensively in some districts, and can also be applied in boring coal seams of any thickness with the "Jackhamer" and cruciform auger steel. This equipment requires very little headroom, hence can be employed in any chamber that a man can enter.

Bulletin 4040

Weight of Frame Complete with Jackhamer (BCR-430)	129 lbs.
Weight of Frame without Carriage and Jackhamer	68 lbs.
Weight of Carriage	20 lbs.
Overall Length of Mounting	7 feet
Overall Width of Mounting	16 inches
Overhang of Frame	1 ft.
Shortest distance from floor to center of Jackhamer	1 ft.
Length of Extension Pointers	1 ft.
Steel used for Boring Coal	1⅞" Solid Twisted Cruciform

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"Butterfly" Non-Rotating Hand Hammer Drill



BC Type—Hand Hammer Drill

This hand rotated drill's distinguishing features are the "Butterfly" valve an automatic oiler and a hole cleaning device, all integral with the tool's construction. The fronthead is spring retained. It may be run with either steam or air and is adapted for work such as pop shooting, breaking up boulders, trimming walls and all work requiring holes not exceeding five feet in depth.

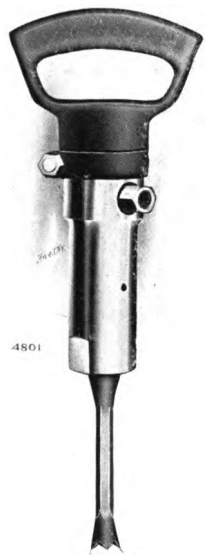
It is built with two styles of handles: The "23" Type or Spade Handle, by which the machine is rotated, and the "26" Type or Swivel Handle with a straight handle on the hammer cylinder for rotation. **Bulletin 4017.**

Length, inches	24
Cylinder diameter, inches	2
Stroke, inches	4
Steel used (hollow hexagon), inch	1
Air Inlet, inch	1/2
Weight of "23" Type, pounds	54
Weight of "26" Type, pounds	65

Equipment: A throttle or stop-cock goes with each tool.

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"Imperial" Hand Hammer Drill



"MV" Type Hand Hammer Drill

This is a valveless tool with but one moving part, the hammer. It is an ideal drill for the lighter plug and feather work, block holing, drilling holes in concrete floors, walls, etc. It is an all steel machine, built in two weights. 7/8" hollow steel with 3" by 7/8" hexagon shank with collar is used.

With ordinary care this machine is almost indestructible. It is recommended where there is not sufficient work to warrant the automatically rotated, and faster drilling "Jackhamers".

It is not suitable for operating on steam.

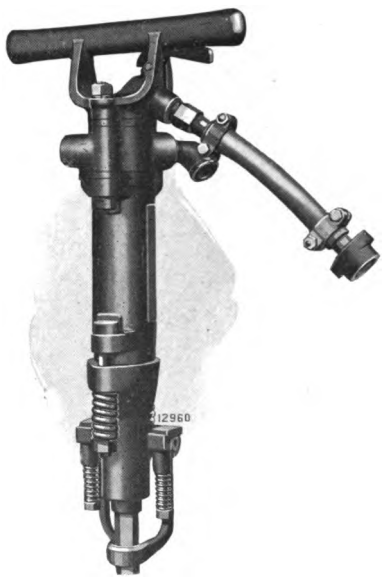
Bulletin 4015.

	"Imperial MV-1"	"Imperial MV-2"
Cylinder diameter, inches	1 7/16 and 1 11/16	1 7/16 and 1 11/16
Stroke, inches	2 1/4	2 1/4
Length over all, inches	15	15
Size of Air Inlet, inches	3/8	3/8
Weight, pounds	22	30

Equipment: A short length of hose goes with each tool, carrying a stopcock or throttle valve.

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Paving Breakers



Type BC-25 Concrete Breaker

These machines are designed along the lines of our non-rotating types of hand hammer drills; with certain essential changes for the work intended, that is, tearing up pavements, ripping out concrete foundations, pillars, etc.

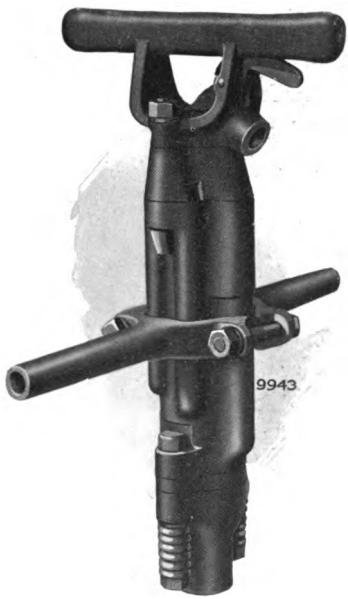
Following are the distinctive features; all steel construction; trigger controlled throttle valve in handle; automatic lubrication; steel holder; spring held fronthead; fast drilling; ease of operation.

Bulletin in preparation

	BC-25	CC-25
Bore of Cylinder, inches	2	1⅜ x 2¾
Length of Stroke, inches	4	4
Length of Drill, inches	24	25
Size of Inlet, inches	½	¾
Size of Hose, inches	¾	¾
Steel, inches	1⅛ solid Hex. with collar	1⅛ solid Hex. with collar
Weight, pounds	58	68
Weight, drill and equipment boxed, pounds	78	90

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Type "CC-25" and "CC-251" Drift Bolt Drivers and Type "CC-250" Spike Driver



Type "CC" Spike Driver

These machines are of extremely simple and rugged construction, being mainly drop forgings accurately ground. They are rapid, easy and economical to operate and will save their cost in a few weeks time because of the increased output.

The Drift Bolt Drivers are built in two types, the "CC-25" and the "CC-251". The former is a hand tool for driving bolts downward, the latter is equipped with an air-feed (described on page 10) for driving bolts upward.

The "CC-250" Spike Driver is similar in construction to the "CC-25" except that the fronthead is shaped to accommodate the standard railway spikes.

Bulletin 8014.

	"CC-25"	"CC-251"	"CC-250"
Weight, without set	65 lbs.	90 lbs.	65 lbs.
Length over all	25″	55″	25″
Length of Feed		22″	
Bore of Cylinder	$1\frac{3}{8}$″ x $2\frac{3}{4}$″	$1\frac{3}{8}$″ x $2\frac{3}{4}$″	$1\frac{3}{8}$″ x $2\frac{3}{4}$″
Length of Stroke	4″	4″	4″
Size of Air Inlet	$\frac{3}{4}$″	$\frac{3}{4}$″	$\frac{3}{4}$″
Size of Hose	$\frac{3}{4}$″	$\frac{3}{4}$″	$\frac{3}{4}$″

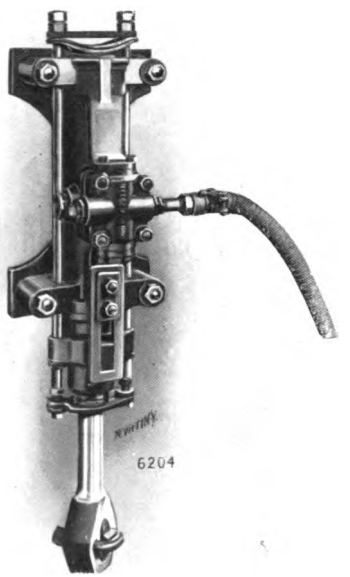
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Submarine Rock Drills

These machines find their application in river and harbor improvements, deepening navigation channels, removing hidden reefs and ledges, canal construction, lock and dock work, etc.

The Ingersoll-Rand Company's line of submarine drills are rugged in construction and powerful in action, embodying various modifications of the standard rock drill line.

As this class of work involves more or less special construction to suit peculiar conditions which may exist, the company will be glad to advise with parties having submarine drilling to do.



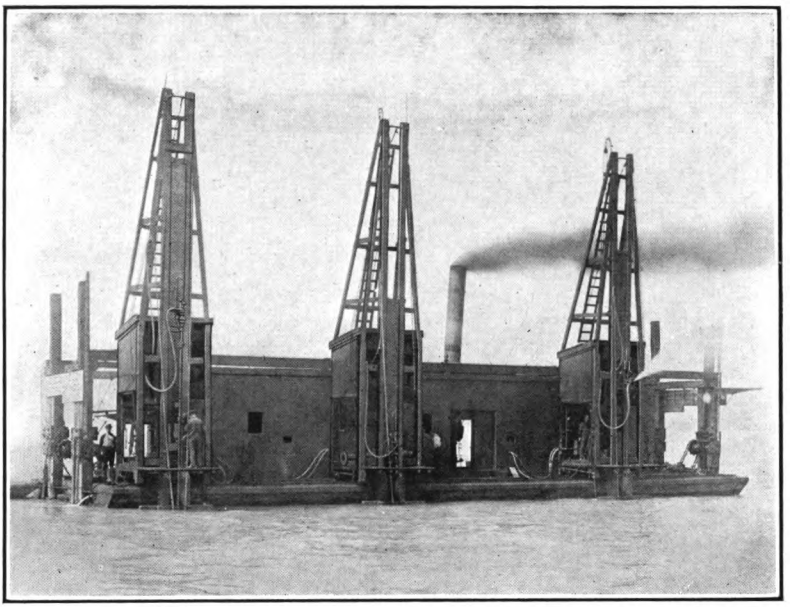
Submarine Rock Drill

Bulletin in Preparation.

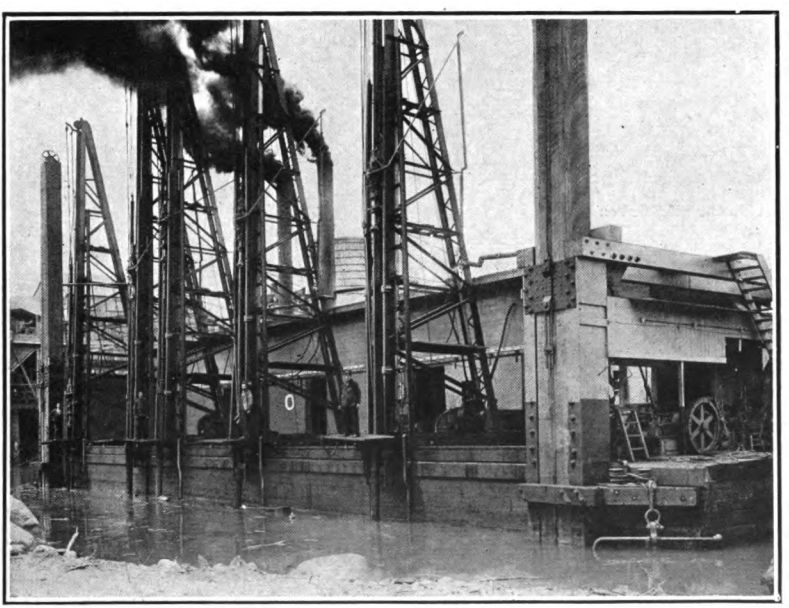
DESCRIPTION	Sergeant G-109	New Ingersoll H-64	New Ingersoll K-64
Dimensions:			
Diameter of Cylinder, inches	4¼	5½	6½
Length of Stroke, inches	8	8	9
Length of drill from end of crank to end of piston, inches	51¼	81	90
Style of mounting	Slab Back	Slab Back	Slab Back
Diameter of supply inlet (standard pipe), inches	1¼	1¼	1¼
Approximate strokes per minute with 75 pounds pressure at drill	400	250	250
Depth of vertical hole each machine will drill easily, feet	1 to 27	1 to 40	1 to 60
Diameter of holes drilled as desired, inches	3 to 6	3 to 6	3 to 6
Average work done per 10 hours in granite down holes, including time lost in setting drill and changing bits, feet	100 to 150	100 to 150	100 to 150
Diameter of octagon steel used, inches	1¾ and 1½	2½ and 2	2½ and 2
Size of shanks (diameters and lengths), inches	1¾ x 6½	2 x 8	2 x 8
Best size of boiler to give plenty of steam at high pressure, H. P.	18	18	25
Approximate Weights:			
Drill, unmounted, with wrenches and fittings, not boxed, pounds	605	1100	1250
Drill, unmounted, with wrenches and fittings, boxed, pounds	725	1350	1500

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Submarine Rock Drilling Scenes



Three drill submarine drilling barge on harbor excavation work



Five drill submarine drilling barge on harbor excavation work

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Submarine Drilling and Charging Tubes and Accessories

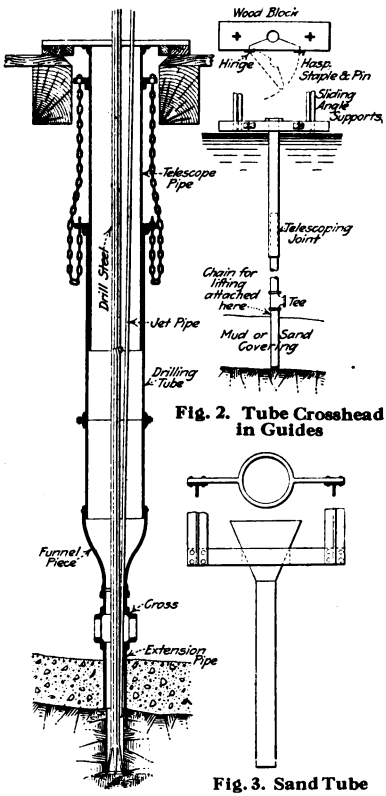


Fig. 2. Tube Crosshead in Guides

Fig. 3. Sand Tube

Fig. 1. Telescopic Tubes

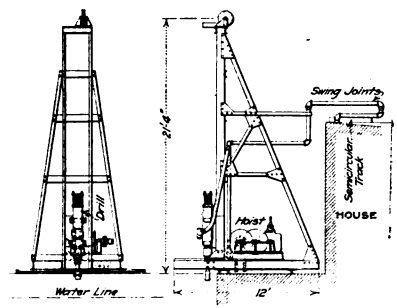


Fig. 4. Wagon Tower used on Submarine Drill Barge

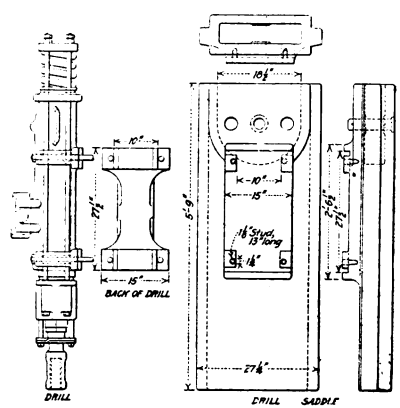


Fig. 5. Submarine Drill Saddle

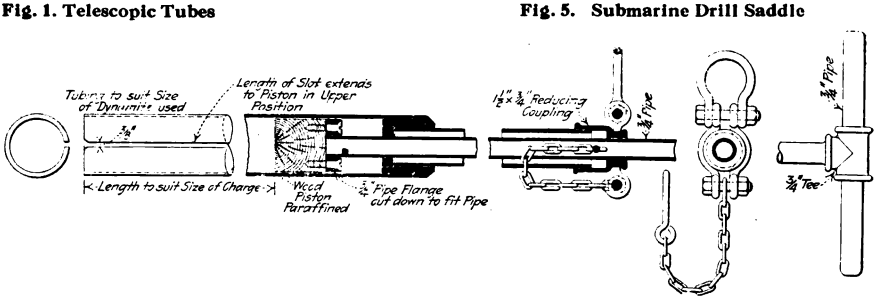
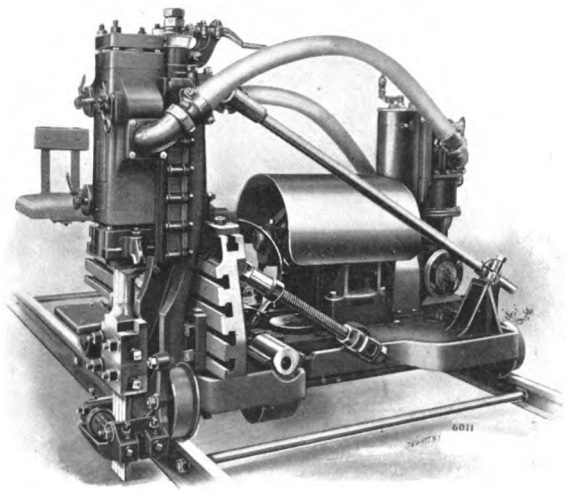


Fig. 6. Charging-stick for Loading Submarine Drill Holes

These accessories are shown for the customer's information. They are not furnished by us.

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Electric-Air Channeler



Electric Air Swing Back Track Channeler

This is the latest development in quarrying machines. It embodies the "Electric-Air" principle eliminating piping, steam, smoke, coal, ashes, and their attendant cost, and inconvenience from the quarry.

The cutting engine operates by pulsation of compressed air produced by a electric-driven air pulsator. The machine is self-contained, all of the mechanism being on the channeler truck.

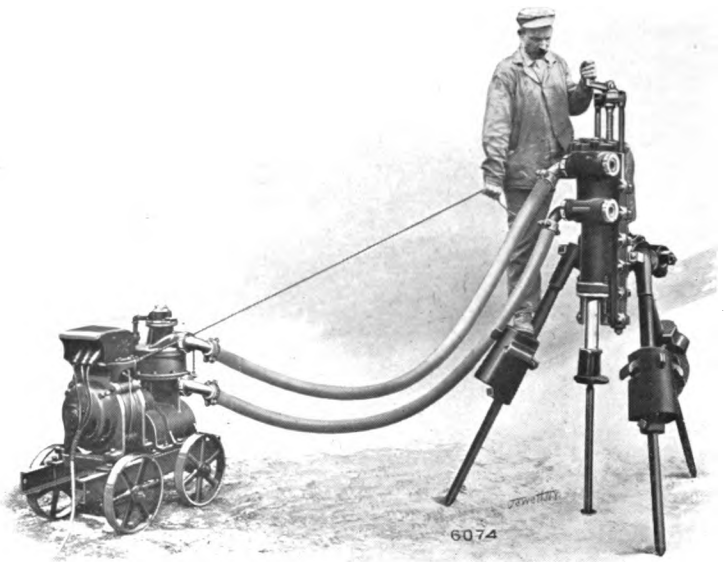
It requires less than half the power of any steam driven machine for similar work. Its success has been proven in the largest quarries in the world where it is now a part of the standard equipment. The channeler is built with a swing back and has hand operated power.

Bulletin 6102.

Diameter of Cylinder, inches	7
Length of Stroke, inches	7
Length of Feed, inches	12 to 15
Angular Range of Swing Back	Vertical to Horizontal
Angular Range of Swivel Head, either way, degrees	45
Inside Gauge of Track, feet and inches	5–10¾
Minimum Distance of Cut from Vertical Wall, inches	7¼
Distance from Center to Center of Cuts with Channeler Reversed on Track, feet and inches	7–5
Distance from Extreme Outer Edge of Rail to Center Line of Cut, inches	5½
Length Over All, feet and inches (along the track)	5–3
Width Over All, feet and inches (across the track)	8–0
Height Over all from Top of Rail, feet and inches	6–3½
Weight of Channeler with D. C. or A. C. Motor, Pulsator and Speed Controller, pounds	8,200
Total Shipping Weight of Channeler complete with D. C. or A. C. Motor, Accessories and Track Equipment, but no Steels, pounds	13,250
Size of Motor supplied for Alternating Current, H. P	12
Size of Motor supplied for Direct Current, H. P	15
Power Required (H. P.) to cut 7 feet deep, for 7" machine, 8 feet for 8" machine	10
Weights are for Domestic Shipment; add 100 lbs. for Foreign Shipment	

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Electric-Air Rock Drill



Electric-Air Rock Drill

This machine is the only time-proved, successful rock drill on the market, operated by electricity. The secret of its success is that compressed air does the work while electricity furnishes the power.

It appeals particularly to the isolated quarry, mine and contract where electric current is available and where the high cost of fuel forms a serious handicap to operations. It is also recommended to the small operator, because its use eliminates a heavy investment in compressor plant equipment.

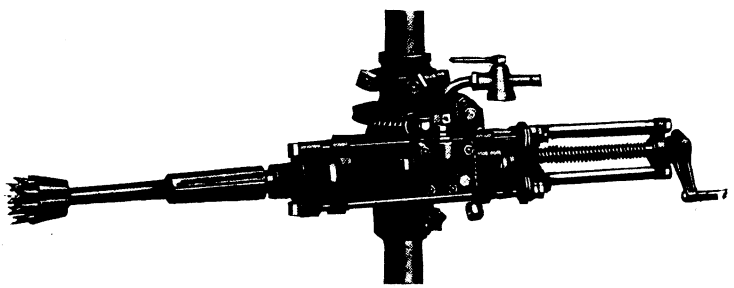
In power, it is the most efficient rock drilling plant manufactured.

Bulletin 4209.

DESCRIPTION	4-E
Specifications:	
Diameter of Cylinder, inches	4¾
Length of Stroke, inches	7
Length of drill from end of crank to end of piston, inches	45
Depth of hole drilled without change of bit, inches	24
Depth of vertical holes each machine will drill easily, feet	1 to 12
Diameter of holes drilled as desired, inches	1¼ to 2
Size of octagon steel used, inches	1 and 1⅛
Size of shanks (diameter and length), inches	1 by 5½
Number of pieces in set of steels, holes and depths as stated	6
Average horsepower required for running drill (motor output)	4
Approximate Weights—Drill:	
Drill unmounted, with caps, not boxed, pounds	228
Drill unmounted, with caps, boxed, pounds	281
Entire equipment, including drill, pulsator, alternating current motor, fittings, wrenches, and extra parts, but no mountings, steels or blacksmith tools, boxed, pounds	1690
Entire equipment, including drill, pulsator, direct current motor, fittings, wrenches and extra parts, but no mountings, steels, or blacksmith tools, boxed, pounds	1740

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Radialaxe Coal Cutters



No. 47 Radialaxe Coal Cutter

The No. 47 Radialaxe Coal Cutter is particularly adapted to entry and heading driving, shearing, cutting out dirt or clay bands, undercutting and shearing in a pitching seam, and many other uses confronting the operator in mining coal. In addition to coal cutting it may be used as a rock drill for regular rock drill work such as "bushing" entries and taking down rock roofs.

Mounted on a drill column it makes horizontal cuts to any desired height, mounted on a short column arm it makes vertical cuts for shearing, etc.

Outstanding, constructions features are; Irco Metal construction, solid one piece fronthead, crank operated worm and gear for swinging the machine back and forth in the cut, auxiliary and main valve mechanism allows a variable length of stroke.

Bulletin 5106.

Essential Details of No. 47 "Radialaxe"

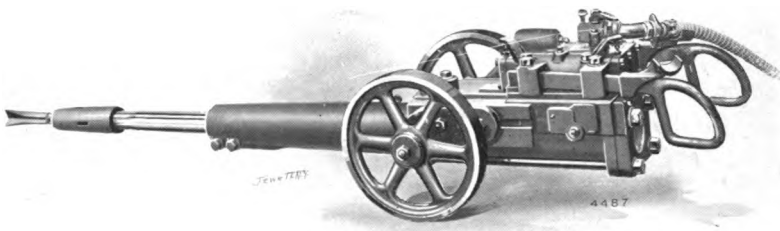
Diameter of Cylinder, inches	3⅞
Stroke (maximum), inches	10
Diameter of supply inlet (Standard Pipe), inches	1
Approximate number of blows per minute at 80 lbs. air pressure,	600
Depth of cut without changing steel, inches	21
Length of machine from end of crank to end of chuck, inches	42

Net Weights:

Machine with chuck, unmounted, pounds	216
Radial mounting, pounds	80
3⅞" column—3'-6" long, with safety clamp, pounds	92
Total of machine and mounting, pounds	391
One set of 5 extension steels up to 8'-0 (longer if required), pounds	98
36 Chisel Bits, pounds	45
One bit holder for 5 chisel bits, pounds	5½
Four bit holders with removable bits, pounds	45
One fifty foot length hose with couplings, pounds	64
Shipping weight complete, pounds	583

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The "New Ingersoll" Puncher



"New Ingersoll" Coal Puncher

Maximum capacity with minimum cost for power and repairs explain its leadership among the most successful mines of the country. The "New Ingersoll" is an "all-round" puncher, adaptable to hard or soft coal, thick or thin seams, high or low air pressure. Its blow is under complete control.

Bulletin 5002.

DIMENSIONS AND WEIGHTS OF COAL PUNCHERS

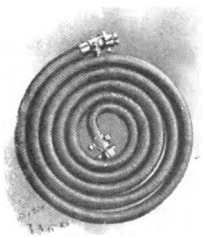
DESCRIPTION	H-4		H-7		H-10		H-12	
	Narrow Gauge	Wide Gauge	Narrow Gauge	Wide Gauge	Narrow Gauge	Wide Gauge	Narrow Gauge	Wide Gauge
Diameter of Cylinder, Inches	5	5	5	5	5½	5½	5½	5½
Length of Stroke, inches	17	17	17	17	17	17	17	17
Diameter of Standard Wheels, inches	17	17	16	16	17	17	17	17
Width Over All, inches	24¼	21¼	24¼	21¼	24¼	21¼	24¼	21¼
*Maximum Length, feet and inches	8-6	8-6	8-6	8-6	8-6	8-6	9-2	9-2
*Minimum Length, feet and inches	7-0	7-0	7-0	7-0	7-0	7-0	7-9	7-9
Height from Floor to Top of Chest, inches	20⅛	20⅛	19¾	19¾	21¼	21¼	21¼	21¼
Depth of Under Cut, feet and inches	5-0	5-0	5-0	5-0	5-0	5-0	5-9	5-9
Width of Under Cut, feet and inches	5-0	5-0	5-0	5-0	5-0	5-0	6-0	6-0
Weight of Machine, including Extension, pounds	835	835	675	675	775	775	850	850
Weight 15-inch Pick, pounds	8½	8½	8½	8½	8½	8½	8½	8½
Weight of Extension, pounds	20	20	16	16	22	22	22	22
Gross Shipping Weight, pounds	1045	1045	885	885	985	985	1080	1080

*These dimensions include Extensions and Picks.

Equipment includes Extension, Wrenches, Oil Can, Hammer and Shovel, boxed. Hose and Picks are not included.

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Coal Cutter Accessories



Coal Cutter Hose

AIR HOSE

The air hose furnished by the Company for punchers and "Radialaxe" machines is of the best quality and has the standard "Sergeant" couplings. 9-ply linen 1″ heavy half-round wire-wound and very flexible. The best hose is the least expensive in coal mine work, which is exceptionally hard, even on the best.

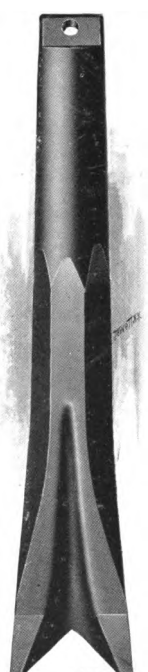
COAL PICKS AND BITS

The Company is prepared to furnish picks or bits for the "New Ingersoll" Puncher or "Radialaxe" machine, of the best quality of steel, made of the proper shape and in every way adapted for the best operating results.

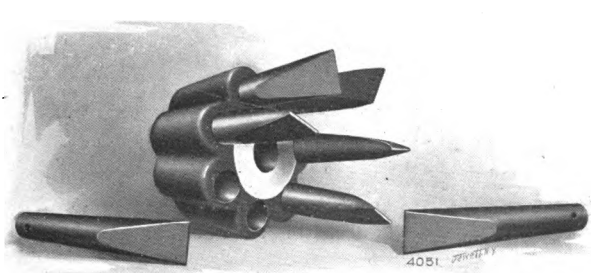
Puncher picks are of the solid two-prong style and are shipped without tempering. The temper should be adjusted to the hardness of the coal being worked. Sharp picks increase the capacity of the puncher and well repay the care in maintaining them.

"Radialaxe" bits are of the style shown below, consisting of a bit holder and a number of small chisel bits fitting in the holder on a taper.

Fish-tail bits or chisel bits are furnished in sets consisting of 4 holders and 36 bits.



Coal Cutter Picks



Coal Cutter Fish Tail Bits

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"Little David" "56-H" Coal Pick



"56-H" Coal Pick

A sturdily constructed pneumatic tool especially adapted to stripping and picking coal. It is also useful for core breaking, tearing up asphalt pavements, etc. It is thoroughly reliable, durable and easily operated with ample capacity to meet the duty imposed by the classes of work for which it is recommended.

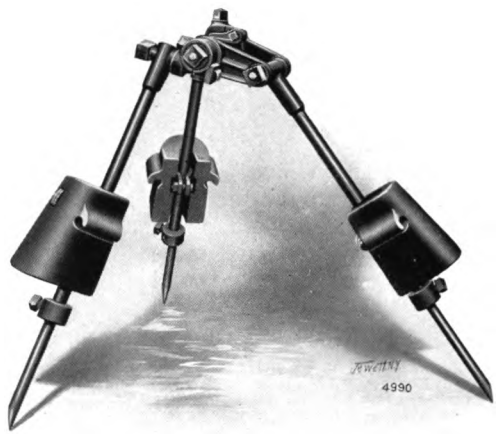
The handle is drop forged and of the closed type with inside trigger. The cylinder is of special steel. The valve is the Spool valve as used in the Crown Pneumatic Hammers. It is provided with a simple spring tool retainer.

Bulletin 8312.

Size No.	56-H
Piston stroke, inches	3½
Length over all, inches	19¾
Weight, pounds	18
Size of inlet, inch	⅜
Hose should use, inch	½

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The Tripod



Rock Drill Tripod Mounting

The "27" Tripod is the standard for all types of Ingersoll-Rand rock drills. All joints have cone surfaces, securing a powerful wedge effect under pressure of the adjusting bolts. The legs are telescopic and the weights adjustable.

The "27" Tripod is regularly furnished with the "Sergeant" saddle for the modern drill types.

Bulletin 9103.

LIST OF STANDARD "SERGEANT" TRIPODS

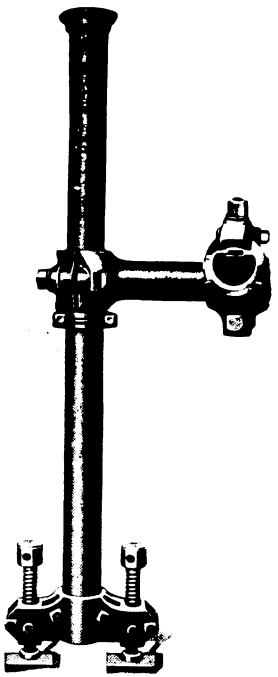
Type	Size Letter (Symbol)	Used for Piston Drills Cylinder Diameter Inches	Size of Cone	Net Weight, Pounds	
				Tripod	Weights
Sergeant.....	A-27	2	5″	90	130
Sergeant.....	A-86	$2\frac{1}{4}$	5″	145	255
Sergeant.....	B-27	$2\frac{1}{2}$	7″	160	255
Sergeant.....	D-27	$2\frac{3}{4}$, 3	7″	174	336
Sergeant.....	E-27	3, $3\frac{1}{8}$, $3\frac{1}{4}$	7″	224	336
Sergeant.....	F-27	$3\frac{1}{2}$, $3\frac{5}{8}$	7″	296	370
Sergeant.....	G-27	$4\frac{1}{4}$, $4\frac{1}{2}$, 5	7″	315	370

NOTE—The Sergeant Saddle is standard and is the form sent with all Sergeant Tripods unless otherwise specified. Sergeant Tripods are always supplied with saddle to mount the type of drill furnished.

NOTE—For mounted JACKHAMERS use the A-27 Tripod.
For LEYNER-INGERSOLL DRIFTERS use the A-86 Tripod

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Rock Drill Columns

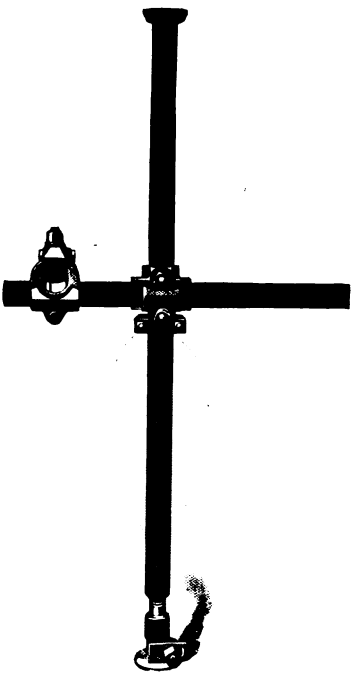


Double Screw Column with Arm Clamp and Safety Clamp

Ingersoll-Rand columns are offered in both single and double screw types. They carry clamps with "Sergeant" saddles, fitting all types of Ingersoll-Rand drills.

The Universal Column arm and clamps permits a wider range of set-up and with more ease. A complete round can usually be drilled with one column set-up when the Universal is used.

In addition to the standard sizes of columns listed in the table, the Company is prepared to furnish extra long columns, and special combinations of columns, arms and clamps.



Single Screw Column Universal Column Arm and Clamp



Single Screw Column or Shaft Bar with Clamp

COLUMN CLAMPS, COLUMN ARMS AND SAFETY CLAMP

Column Clamps			Column Arms			Safety Clamps		"Universal" Column Arm		
Size of Clamp Inches	Size of Cone Inches	Weight Pounds	Size Inches	To be Used with Column Size Inches	Weight Pounds	Size Inches	Weight Pounds	Size of Arm Inches	Size Column used with Inches	Weight Pounds
3	5	25	3	3	30	3	6	3	3	49
3½	5	40	3½	3½	50	3½	7	3	3½	54
3½	7	55								
4	5	40	4	4	60	4	8			
4	7	55								
4½	7	75	4½	4½	80	4½	9			
5½	7	85	5½	5½	90	5½	10			

Note:—This arm is 36" long compared to 22" for standard Arm Clamp same as per above list.

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List of Standard Single and Double Screw Columns

DOUBLE SCREW COLUMN

Outside Diameter	Minimum Length Screws Run in Feet	Suitable for Piston Drills Cylinder Diameter Inches	Approximate Weights, Pounds		
			Column Complete	Arm, Clamp and Safety Clamp	
				5-inch Cone	7-inch Cone
3	6	2 to 2½	140	60	95
3	8	2 to 2½	156	60	95
3½	6	2¼, 2½	227	95	110
3½	8	2¼, 2½	247	95	110
4	6	2½, 2¾	258	110	125
4	8	2½, 2¾	283	110	125
4½	6	2¾ to 3¼	344		165
4½	8	2¾ to 3¼	374		165
†5½	6	3½, 3⅝	410		185
†5½	8	3½, 3⅝	450		185

SINGLE SCREW COLUMN

Outside Diameter	Minimum Length Screws Run in Feet	Suitable for Piston Drills Cylinder Diameter Inches	Approximate Weights, Pounds		
			Column Complete	Arm, Clamp and Safety Clamp	
				5-inch Cone	7-inch Cone
3	6	2 to 2½	95	30	
3	8	2 to 2½	110	30	
3½	6	2¼ to 2¾	155	45	
3½	8	2¼ to 2¾	175	45	
4	6	2½ to 2¾	185	50	
4	8	2½ to 2¾	210	50	
4½	6	2¾ to 3¼	230		85
4½	8	2¾ to 3¼	260		85
5½	6	3½, 3⅝	310		95
5½	8	3½, 3⅝	350		95

†Standard 5½" column has 4½" arm and 4½" clamp and is special if wanted with 5½" arm and 5½" clamp.

NOTE—For mounted JACKHAMERS use 3" column with 5" cone.
For LEYNER-INGERSOLL DRIFTERS use 3½" column with 5" cone.

Bulletin 9103.

The length of column should always be specified as *closed, i. e., with the screws clear in.* Always allow from 10 to 14 inches for wood blocking. Column made any length, as specified.

Prices of Single Screw Columns complete do not include arm, which is not sent unless specified.

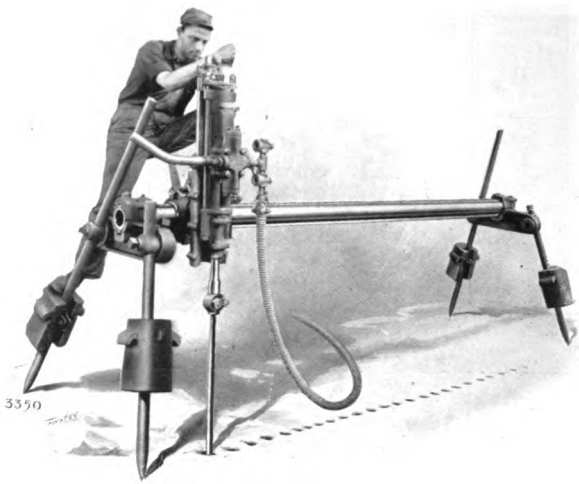
If arm and clamp, are not wanted on double screw column, it should be so specified.

The weights of the double screw column include Column Arms of the same diameter as the Column, which will be furnished unless otherwise specified, except 5½-inch.

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The Quarry Bar

The Ingersoll-Rand Quarry Bar combines great strength and rigidity with a wide flexibility of adjustment for difficult set-ups. The leg posts turn on the end pieces and the legs have sliding adjustment through the leg posts. The bar is a tube of extra heavy steel, with a rack-and-pinion for



Rock Drill Quarry Bar

causing the longitudinal travel of the carriage and a spline to prevent the carriage turning on the bar. The saddle clamp carrying the drill, however, turns on the carriage, so that parallel holes can be drilled in any plane from horizontal to vertical.

Bulletin 9103.

INGERSOLL-RAND QUARRY BARS

Description and Size	Length of Bar Over All in Feet	Length of Cut Feet and Inches	Can be Used with Drills Cylinder Diameter Inches	Weight with Weights but without Drill Pounds
Light, 3-inch.....	10	8-4	2, 2¼, *2½	860
Standard, 4½-inch....	12	10-0	*2¼, 2½, 2¾, 3, 3¼, 3½, 3⅝	1460

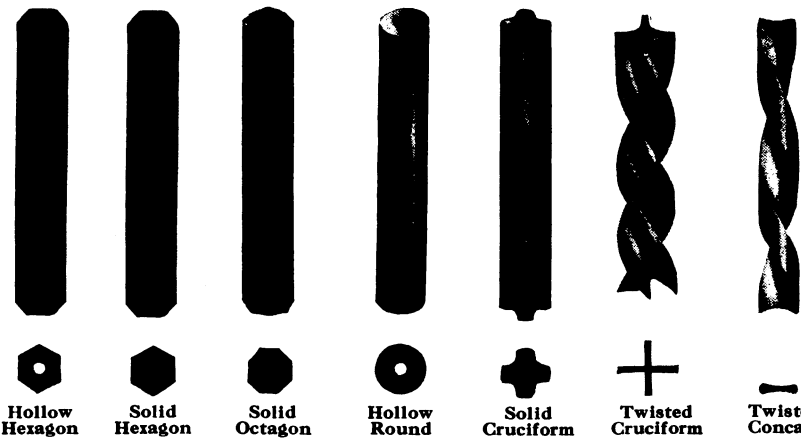
*When a 2½-inch Drill is used on the 3-inch Light Quarry Bar, or a 2¼-inch Drill is used on the 4½-inch Standard Quarry Bar, a special saddle is necessary.

Complete Quarry Bar includes Carriage, Weights and Wrenches, but no Drill.

Shorter bars than those above listed will be furnished without increase in price.

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Drill Steel

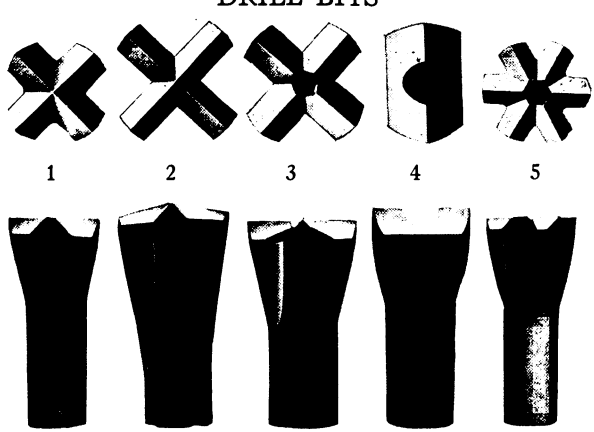


Ingersoll-Rand Drill Steel is offered to the trade as the best obtainable steel on the market for rock drilling purposes. This steel has been carefully manufactured in accordance with specifications, based on our long and extensive experience.

A large supply of standard sizes and shapes of drill steel, both hollow and solid is always carried in stock. Prompt shipment can be made in almost any quantity; car lots and ton lots in random lengths.

Finished sets of drill steel that will take care of almost all conditions can usually be furnished from stock.

DRILL BITS

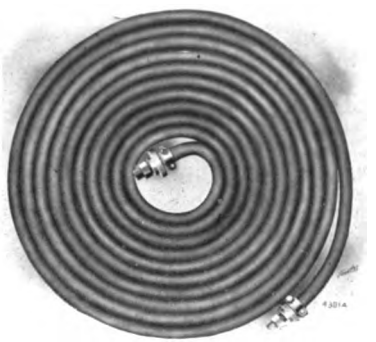


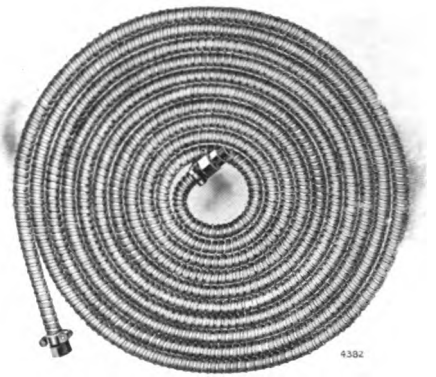
1—Cross (+) Bit on Solid Steel. 2—Crown Bit on Solid Steel. 3—Cross (+) Bit on Hollow Steel. 4—Carr Bit. 5—Rose (6 Point) Bit on Hollow Steel.

The sizes of bits in a set of steels should differ in gauge only enough to insure following of each successive bit. The smaller a hole can be started and still give the desired diameter at the bottom, the faster it will be drilled.

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Steam and Air Hose





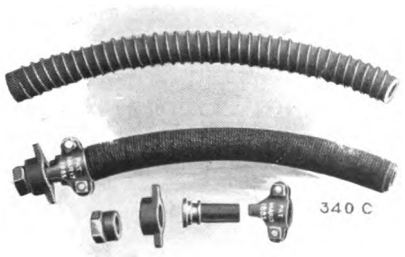
Steam and air hose in any ply and size desired is furnished by the Company for use with either piston or hammer drills. The hose may be plain, canvas wrapped, linen wrapped, marline wound or wire wound. In the latter case, round, half round or flat wire winding can be supplied. The quality in any style is guaranteed to be the very best obtainable, affording the best value for the price.

The following sizes are carried in stock.

Description	Inside Diameter Inches
STEAM HOSE—ROCK DRILLS	
5 Ply—Marlin Wound	¾
5 Ply—Marlin Wound	1
5 Ply—Heavy Half Round Wire Wound	¾
5 Ply—Heavy Half Round Wire Wound	1
AIR HOSE—ROCK DRILLS	
5 Ply—Plain	¾
5 Ply—Plain	1
5 Ply—Canvas Cover and Heavy Half Round Wire Wound	¾
5 Ply—Canvas Cover and Heavy Half Round Wire Wound	1
ANTIPEEL AND GRADE "A"—HAMMER DRILL AND PNEUMATIC TOOL	
7 Ply—Plain	½
7 Ply—Plain	¾
9 Ply—Plain	1
7 Ply—Heavy Half Round Wire Wound	½
7 Ply—Heavy Half Round Wire Wound	¾
9 Ply—Heavy Half Round Wire Wound	1
COAL CUTTER HOSE	
9 Ply—Linen, Heavy Half Round Wire Wound	1

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Hose Couplings and Menders



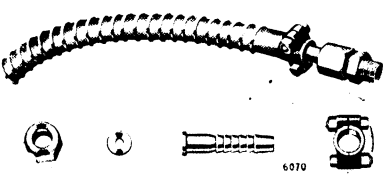
"Sergeant" Hose Couplings

HOSE COUPLINGS

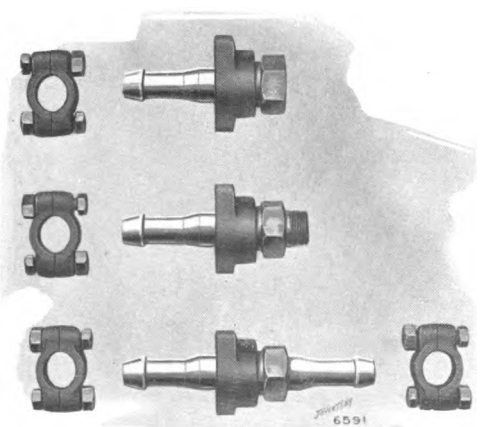
Size Inches	Complete with Spud Weight Lbs.	Oz.	Spud Only Weight Lbs.	Oz.
½	2	8	0	9
¾	2	11	0	10
1	2	13	0	11
1¼	4	5	0	12
1½	4	9	0	13
2	6	1	0	14
2½	11	13	2	3
3	15	12	3	0

HOSE MENDERS

Size Inches	Weight Lbs.	Oz.
¾	1	12
1	2	8
1¼	3	0



"Leyner" Hose Couplings



"Jackhamer" and "Stopehamer" Hose Couplings

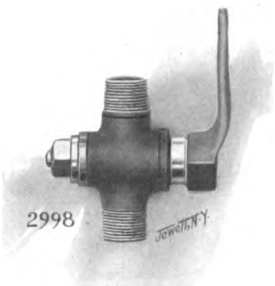
Styles are Hose to Male Pipe, Hose to Female Pipe, and Hose to Hose.

Dimensions are ¼-inch, ⅜-inch, ½-inch, ¾-inch and 1-inch.

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Rock Drill Throttles, Oilers and Manifolds

ROCK DRILL THROTTLE VALVES



The "Old Style" Throttle

Type	Size Inches
"Old Style" Throttle	¾
"Old Style" Throttle	1
"New Ingersoll" Throttle	¾
"New Ingersoll" Throttle	1
"New Ingersoll" Throttle	1¼

Note—An excellent practice for operators to follow is to throw the throttle handle in opposite directions on alternate days, thus securing a uniform wear between plug and seat.



"New Ingersoll" Throttle

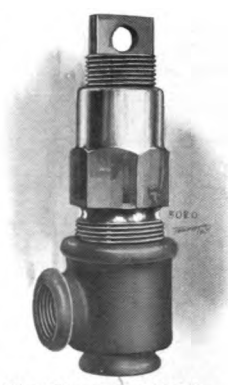
ROCK DRILL OILERS



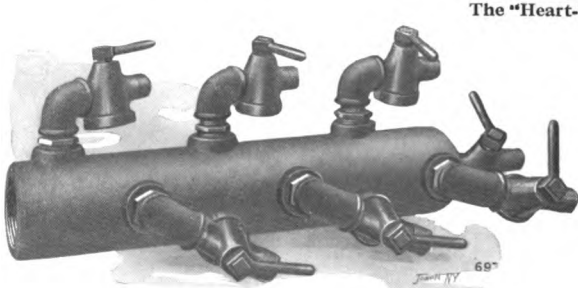
The" New" Ingersoll Oiler

Type	Size Inches
"New Ingersoll"	¾
"New Ingersoll"	1
"Heart-Beat"	*

*Furnished in only one size; If symbol of drill for which oiler is intended is given, suitable reducing tee can be furnished without extra cost.



The "Heart-Beat" Oiler



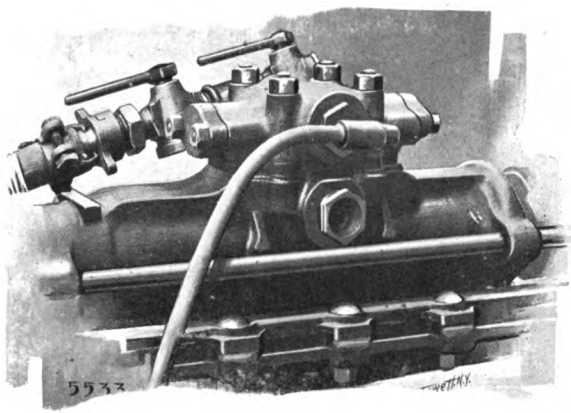
Manifold or Header

DESCRIPTION	Number of Drills for which intended	Weight Pounds
Manifold with ¾-inch, 1-inch and 1¼-inch Throttles (New Ingersoll)	4	47
	6	55
	7	60

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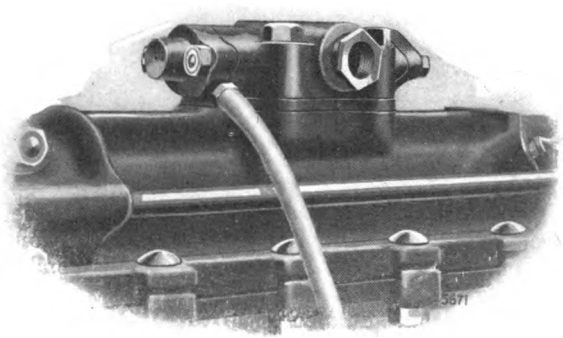
Water Spray for Rock Drills

The Dustkiler illustrated herewith, is extremely simple, consisting of a small attachment suitably fixed to the drill, which under the impulse of a small volume of compressed air from the drill sprays or atomizes the water and directs the jet against the mouth of the hole. Thus the dust is allayed before it has a chance to mingle with the atmosphere.



The "Dustkiler" in Place on a Drill

Any receptacle will do for the water and the nozzle does not clog or choke easily. The spray is under instant control and can be used as needed. But very little air is required and the added weight is inappreciable. When wet ground makes it unnecessary the Dust Allayer may be quickly removed, and it can be as quickly replaced when required. The range of the spray from the nozzle is ample to cover all ordinary drilling conditions.



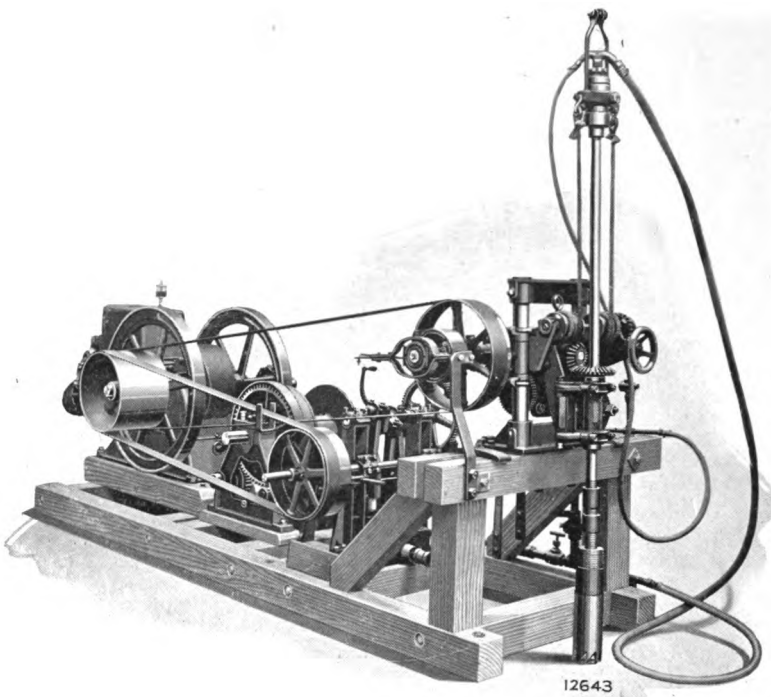
The "Barnet" Spray Ready for Use

The great advantage of the *Barnet Spray* is that it forms an integral part of the drill. There is nothing exposed to injury or breakage. There is no added complication. The device is self-contained and extremely simple. There is nothing to wear out. Attaching it to a drill calls for no special parts and no fitting beyond the drilling of a small hole through one valve washer. Its use adds but a small percentage to the air consumption of the drill and a short length of plain hose furnishes the water from a pail, can or other source. And not a great deal of water is used, because of the effective dust-laying action of the fine spray.

When air is turned on to the drill, a small portion of it is discharged from the forward end of the valve chest at each alternate movement of the valve, through the spray plug and out through the nozzle. This air creates, in passing, a partial vacuum in front of the spray plug, which draws water up through the hose and into the spraying device, where it is caught by the air jet from the chest and blown out through the nozzle in a fine spray.

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The "Calyx" Core Drill



Class "G" Calyx Core Drill

The "Calyx Diamondless" Core Drill differs from the ordinary diamond core drill in that it uses "Calyxite" (chilled shot) or a Davis cutter, for soft formations, in place of the costly diamonds. This eliminates at once one of the principal items of cost in core drilling. In fact, a complete "Calyx" outfit may often be purchased at a price which would hardly cover the diamond bits alone for an ordinary diamond drill.

The "Calyx" drills straight holes and cuts cores up to 14¾ in. diameter very economically.

The standard line of "Calyx" drill includes machines driven by steam engine, gasoline engine, hand-power or horse-power. There is almost no limit to the depth capacity and standard sizes will handle cores from 1½ in. to 14¾ in. in diameter. The "Calyx" Drill will remove cores in any material from 30 to 50 per cent cheaper than any other method.

The following are some of the applications of the "Calyx" Drill: Prospecting for minerals, coal, stone, etc; foundation soundings for buildings, bridge piers, locks, dams and docks; drilling wells for water, oil or gas; drilling large holes for plunger elevators, mine ventilators, anchor bolts, etc.; also special highway pavement testing outfits. Bulletin 9201.

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Calyx Core Drill

Class of Machine	Type of Drive	Size of Hole Bored	Diam. of Core Removed	Depth Capacity	Engine Horse Power	Boiler Horse Power	Shipping Weight of Standard Outfit	
							Domestic Lbs.	Foreign Lbs.
AB-1	**Steam Driven**	**6⅞ to 16¼**	**5½ to 14¾**	**2000 to 4000**	**20 to 40**	**40 to 50**	**Varies with equipment**	
AB-4	**Power Driven**	**6⅞ to 16¼**	**5½ to 14¾**	**2000 to 4000**	**20 to 40**		**Varies with equipment**	
BCF-1	**Steam Driven**	**5⅞ to 16¼**	**4½ to 14¾**	**1800**	**15**	**20 to 25**	**24600**	**26800**
BCF-4	**Power Driven**	**5⅞ to 16¼**	**4½ to 14¾**	**1800**	**15**	**——**	**24600**	**26800**
F-1	**Steam Driven**	**3¼ to 6⅞**	**2 to 5½**	**800**	**7.8**	**12 to 15**	**6800**	**8200**
F-2	Horse Power Driven	3¼ to 6⅞	2 to 5½	500	—	—	7500	7760
F-3	Gasoline Engine Driven	3¼ to 6⅞	2 to 5½	800	10	—	8900	10000
F-4	Power Driven	3¼ to 6⅞	2 to 5½	800	10	—	6900	7900
G-0	Hand Power	2¾ to 3¾	1½ to 2½	250	—	—	2630	2950
G-1	Steam Driven	2¾ to 4¾	1½ to 3⅜	400	5	10 to 12	5000	5900
G-2	Horse Power Driven	2¾ to 3¾	1½ to 2½	300	—	—	3100	4100
G-3	Gasoline Engine Driven	2¾ to 4¾	1½ to 3⅜	400	6	—	6150	7350
G-31	Gasoline Engine Driven	2¾ to 3¾	1½ to 2½	300	6	—	4800	5700
G-4	Power Driven	2¾ to 4¾	1½ to 3⅜	400	6	—	4800	5700
G-41	Power Driven	2¾ to 3¾	1½ to 2½	300	6	—	3750	4350
FP-3	Gasoline Engine Driven	3⅞ to 7⅞	2½ to 6⅜	For Testing Pavement	6	—	2350	2550
FP-4	Power Driven	3⅞ to 7⅞	2½ to 6⅜	For Testing Pavement	6	—	1650	1850

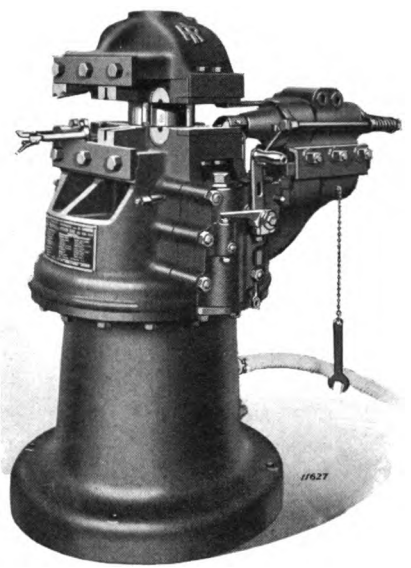
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"Ingersoll-Rand" No. 50 Drill Sharpener



The Ingersoll-Rand No. 50 Sharpener is the very latest development in drill steel sharpening machines. It rapidly and exactly forms and sharpens Carr, 4 point, 6 point, "X", "Z", single and double chisel bits up to 3⅝" gauge and all standard types and sizes of shanks on cruciform steel up to 2" diameter and on heavier sections such as, round, hexagon, octagon, etc., up to 1¾" in diameter. It can be equipped to form boltheads, pins, stanchions and in all about 200 different products.

The I-R No. 50 includes many new features and distinctive improvements, such as, extra strong massive base; improved dolly cylinder; built in "Heartbeat" lubricator; device for keeping dies and cylinder free of scale; single lever control. The work is always in full view of the operator.

Its capacity is, resharpening medium size steels, 65 to 120 per hour. Forming new bits, 25 to 100 per hour.

Standard equipment furnished includes; air line hose connection, drill rest, hose and nozzle for cleaning the machine, 6 extra dolly springs, 2 extra side rod springs for hammer cylinder and 3 wrenches.

Dies, dollies, formers, swages and special devices are extra.

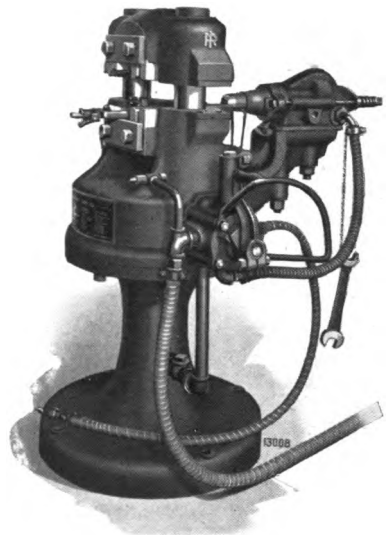
Bulletin 4044.

STANDARD EQUIPMENT	Dimensions and Weights			
	Height Inches	Length Inches	Width Inches	Weight Pounds
Bare Machine	53	47	37	2525
Floor Stand				35
Air Line Connection, complete				12
Six extra Dolly Springs				7
Two extra Side Rod Springs				2½
Three Wrenches				5
Floor Space, without drill rest, Plank Foundation		48	48	
Machine knocked down, boxed for domestic shipment	43	58	48	3175
Machine knocked down, boxed for export shipment	43	58	48	3175
Machine knocked down boxed for export, Sharpener only				*3175

*Weight of dies, dollies, etc., should be added to these weights to determine shipping weight of a complete outfit.

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Ingersoll-Rand No. 4 Drill Sharpener



This size is designed, when fitted with the necessary dies, dollies, formers, etc., for making and resharpening two, four and six point and "X", "Z" and single and double chisel bits up to 2¼ inches in diameter, on round, cruciform, hexagon, octagon, quarter octagon and the heavier sections of twist or banded steel of diameters not to exceed 1⅛ inches. (For heavier work the I-R No. 50 Sharpener is recommended.)

The No. 4 may also be fitted, by the addition of various special devices which can be furnished at extra cost, for shanking small hammer and piston drill steel of a diameter not exceeding 1⅛ inches and for forming small plug drills and stone working tools. To obtain the most efficient work, an air pressure of at least 75 pounds should be maintained.

Capacity: Resharpening medium size steel, 50 to 100 drill bits per hour; forming new bits, 20 to 75 drills per hour.

Standard equipment furnished includes air line connection, drill rest, hose and nozzle for cleaning the machine, three extra dolly springs, two extra side rod springs, one safety block, one sight feed oiler and three wrenches.

Dies and dollies, formers, swages, and special devices are extra.

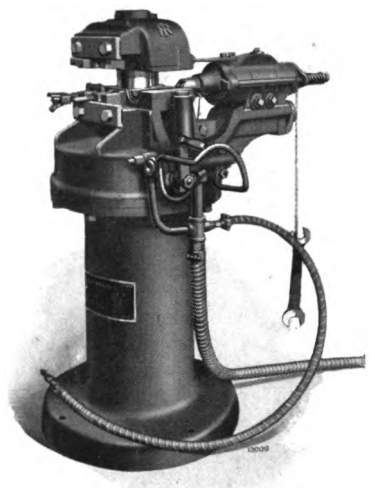
Bulletins Nos. 4222 and 4027.

STANDARD EQUIPMENT	Dimensions and Weights			
	Height Inches	Length Inches	Width Inches	Weight Pounds
Bare Machine	52	43	32	1650
Floor Stand				35
Air Line Connection, 1 inch, complete				24
Three extra Dolly Springs				3
Two extra Side Rod Springs				1¼
One Sight Feed Lubricator				2
Three Wrenches				14
Floor Space, without drill rest, Plank Foundation		48	48	
Machine knocked down, boxed with above parts (for export)	34	54	45	*2150
Machine knocked down, boxed with above parts (domestic shipment)	33	52	43	*2025

*Weight of dies, dollies, etc., should be added to these weights to determine shipping weight of a complete outfit.

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Ingersoll-Rand No. 33 "Jacksteel" Drill Sharpener



The "Jacksteel" Sharpener will be found of particular value in the small mine, quarry, or contract employing two or more drills of the "Jackhamer" and "Stopehamer" type when the steel range is within the capacity outlined below.

They are designed when fitted with the necessary dies, dollies, formers, etc., for making and resharpening four, five or six point, and "X", "Z" and single or double chisel bits up to maximum of 2 inches diameter, where the bits are of the standard 14 degree taper. For "Carr" bits and other types of bits of a taper other than standard, the capacity is limited to bits not exceeding 1⅞ inches finished diameter. These bits can be made on round, cruciform and the lighter sections of twisted or banded steel not exceeding 1⅛ inch in diameter; on hexagon or octagon steel up to 1 inch diameter; and on square steel not exceeding ⅞ inch.

This sharpener may also be employed, when equipped with the various special shanking devices, for making collar shanks on ⅞" hexagon steel or ¾" square steel.

When equipped with the special swaging devices, it will make swaged shanks, or true up the striking end, on hexagon, octagon, round and cruciform steel, not exceeding 1" diameter; square steel up to ⅞", and the lighter sections of twisted and banded steel not exceeding 1⅛" diameter.

Capacity: Resharpening ⅞" steel—75 to 100 drill bits per hour. Forming new bits—50 to 75 drill bits per hour.

Auxiliary equipment furnished; air line connection complete, drill rest, blow gun with hose, safety block, sight feed oiler, dolly spring lever, two shims for former, one shim for swages, three extra dolly springs, two extra side rod springs, four wrenches.

Dies, dollies, formers, swages, and special devices are extra.

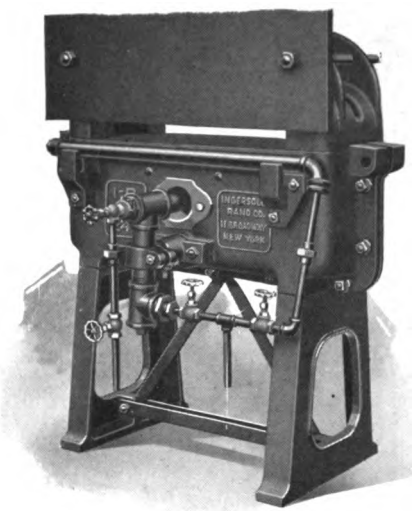
Bulletins 4222 and 4037.

STANDARD EQUIPMENT	Dimensions and Weights			
	Height Inches	Length Inches	Width Inches	Weight Pounds
Machine Bare	48	36	28	925
Floor Stand				33
Floor Space without Drill Rest		36	28	
Plank Foundation		42	42	
Boxed (for export or domestic shipment)	53	37	32½	1190
Three Extra Dolly Springs				1 lb. 3 oz.
Two Extra Side Rod Springs				10 oz.
Sight Feed Lubricator				2 lb. 8 oz.
Four Wrenches				10 lb. 14 oz.

Weight of dies, dollies, etc., which are extra, should be added to the above to determine shipping weight of a complete outfit.

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"Ingersoll-Rand" No. 24 Oil Furnace



The Ingersoll-Rand No. 24 Oil Furnace is designed to meet the demand for one of larger capacity. It can effectively heat 1,600 to 2,400 pieces per eight hour shift using only one side of the furnace and both sides may be used. Sometimes one side is used to heat for forging and the other for tempering. However, it is usually preferred to do these two operations separately because of the different heat intensities required.

The important features of the Ingersoll-Rand No. 24 are; economy in fuel consumption and floor space; exceptional heating capacity; absence of destructive impurities in fuel; and of soot, smoke and ashes in the smith-shop. The steel while being heated is always visible to the operator and the furnace is completely under his control.

Bulletin 9031.

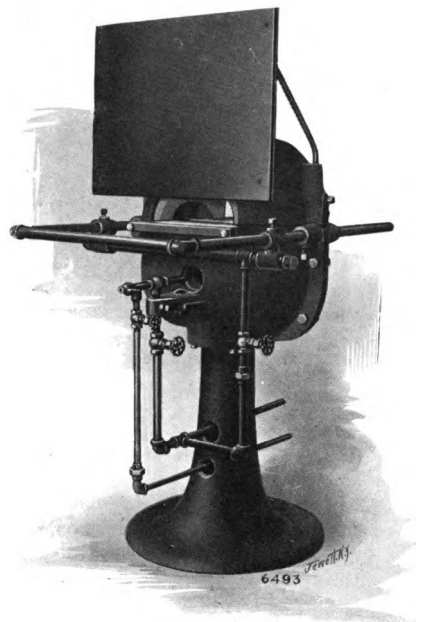
	Weight Unboxed	*Weight Boxed*
Furnace complete with burner and tiling (no tank)	1070 lbs.	1240 lbs.
One complete set of tiling	300 lbs.	375 lbs.
Oil tank of 42 gals. capacity	150 lbs.	205 lbs.
Dimensions boxed, Furnace, Burner and Tiling	52" x 46" x 26"	
*Dimensions—boxed, tank only	22" x 22" x 52"	
Dimensions of 42 gal. Oil Tank	18" diam. x 48" long	
Heating Surface of Furnace	6" x 24"	
Capacity of Furnace (Drills per hour)	200 to 300	
Air Consumption (Free air per minute, sea level)	30 cu. ft.	
Oil Consumption per hour	2 to 4 gals.	
Floor Space required for Furnace only	3' x 4'	
Code Word		

(*Note—Air pressure must be specified.*)

**For Domestic Trade, the Tank is shipped unboxed.*

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Ingersoll-Rand No. 3 Oil Furnace



The No. 3 Oil Furnace is especially adapted to drill steel sharpening plants employing one sharpener, and is capable of heating one thousand to fifteen hundred pieces per eight hour shift.

It gives a clean uniform heat which is at all times under the control of the operator and which is suitable for welding and tempering without special preparation; the smoke nuisance is abated and the absence of obnoxious gases is noted. The steel cannot be injured by absorbing injurious element such as sulphor, phosphorous, etc. found in nearly all coals, nor from unequal heating as the steel is heated in flame only, and at all time in full view of the operator. The absence of smoke, dust, ashes, etc. makes the furnace adaptable to underground installations. No foundation is required and to put the furnace in operation it is only necessary to connect it to the oil and air supply, for the entire outfit is compact and self-contained.

Bulletin 9120

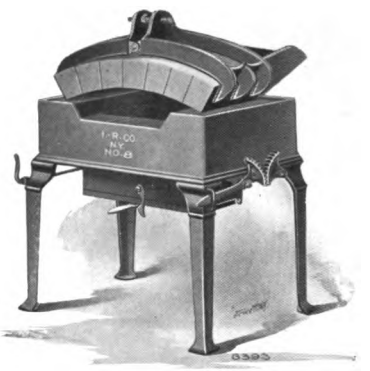
	Unboxed Weights *Lbs.*	*Kilos*	*Boxed Weights* *Lbs.*	*Kilos*
Furnace complete with low pressure burner and tiling—no tank	530	240	705	320
One complete set of tiling	150	68.04	200	90.8
Oil Tank	105	47.62	205	93.0

	Length	*Width*	*Height*
Dimensions boxed, furnace, burner and tiling only	50½″	28″	23½″
Meters	1.28	.71	.60
*Dimensions boxed, Tank only	22″	22″	52″
Meters	.56	.56	1.32

Capacity of Tank	42 Gals. — 158.98 Liters
Heating Surface of Furnace	7½″ x 10″ — .19 x .254 Meters
Capacity of Furnace (Drills per hour)	150 to 200
Air Consumption per minute (free air at sea level)	50 to 75 cu. ft. — 1415 to 2122 Liters
Oil Consumption (per hour)	2 to 4 Gals. — 7.6 to 15.1 Liters
Floor space required for Furnace only	3′-0″ x 4′-0″ — .9144 x 1.2192 Meters

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No. 8-B Coke Forge



The Ingersoll-Rand No. 8-B Forge has been designed specially for the heating of drill steel, both for forging, welding and tempering.

Provision for cleanliness has been made by the use of specially constructed dumping grates and the relation of the heating box to the fire.

It is intended for burning hard coal or coke, which give a clean, uniform fire and avoid annoyance from obnoxious smoke and gases.

The control which the operator is enabled to exercise over this forge is such that danger of burning steel has been reduced to the minimum. The opening in the forge is so arranged that the steel is in complete view of the operator at all times. The value of this can be readily appreciated, as the burning of steel incapacitates it for use, owing to the interference experienced in obtaining a proper temper afterwards.

The forge is neat in appearance, very compact and economical in the use of fuel, and has a large heating capacity.

GENERAL CONSTRUCTION

The design embodies a rectangular metal box, lined with fire brick, and a metal arch also lined with fire brick, for confining the heat. The air blast is delivered in the air box, which is also the ash box and reaches the fire, through the whole area of the grates, the force of the blast being regulated by a valve. The grates are hung on trunnions at their extreme outer corners so that, in dumping, they swing down from the center, allowing the ashes to drop through and out of the forge. The dump opening is the full size of the grate surface. One lever shakes and dumps the grates.

To obtain the most satisfactory results from the use of this forge, a number of steels should always be kept in the fire, as soon as one is forged replacing it with another; the operation thus becomes a continuous one.

Bulletin 9019.

ESSENTIAL DETAILS

Two grates, each 4½ x 18 inches, giving a fire surface 9 inches deep with an 18-inch opening.

Height, 55 inches.

Width, 25 inches.

Length, 34½ inches.

Weight, unboxed, complete, as shown, 900 pounds.

Weight, boxed, complete, as shown, 1100 pounds.

Dimensions, boxed, 37 x 35 x 26 inches.

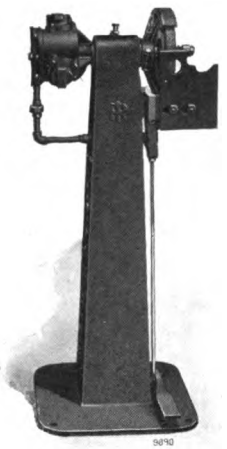
Floor space, 25 x 34½ inches.

Capacity for heating bits, 350 to 500 per 8 hours.

Standard equipment includes the forge complete with brick.

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Leyner No. 8 Pedestal Grinder



The Leyner No. 8 Pedestal Grinder is a compressed air operated machine.

It is principally used for squaring off and grinding true, rock drill steel shanks. It will save its cost in a comparatively short time by eliminating the drill breakage caused by improper shanks.

It is equipped with a bit chuck for ½" straight shank drills or reamers so that it will solve many annoying drilling, reaming and grinding problems that arise in a blacksmith shop.

It is simple, self-contained and its light weight makes it entirely portable.

This machine should be part of the standard equipment of every drill steel sharpening shop.

The standard equipment consist of the grinder and pedestal, one 1" x 8" Norton No. 24 Grade Q Alundum wheel, one Bit Chuck for ½" straight shank drill or reamers, with wrench. Hose is furnished at an extra price.

Bulletin 4141.

Weight complete	195 lbs.
Width of base	17"
Length of base	18"
Length overall	20 3/8"
Height overall	44 5/8"
Diameter of wheel end of crank shaft	5/8"
Diameter of standard wheel	8"
Width of standard wheel	1"
Kind of wheel recommended	Norton No. 24 grade Q Alundum
Size of pipe connection	½"
Suitable for air pressures	60 to 100 lbs. per square inch

Note:—The No. 8 Grinder will accommodate wheels from 6" to 8" in diameter and from 1" to 2" in width.

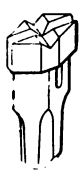
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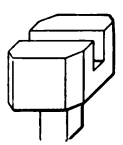
Hand Blacksmith Tools

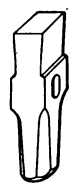
For the small operator who does not have a Leyner Sharpener or for use where one of these machines is not available, the following sets of blacksmith tools, for forming shanks and making or resharpening bits by hand, are recommended.

TOOLS FOR 4 POINT BITS

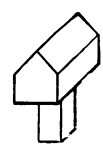

4 Point + Bit


Square Dolly


Square Sow


Flatter

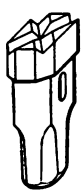

Spreader

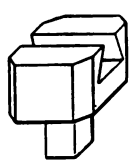

Swage

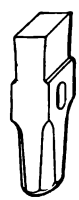

Center Punch

TOOLS FOR 4 POINT X BITS

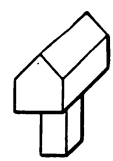

4 Point X Bit


X Dolly


X Sow


Flatter


Spreader


Swage


Center Punch

The dollies in these sets are made to dress flat face bits which are now standard. Dollies for high center bits are not carried in stock.

TOOLS FOR 6 POINT BITS


6 Point Rose Bit


6 Tooth Dolly


4 Tooth Dolly


Gouge


Center Punch

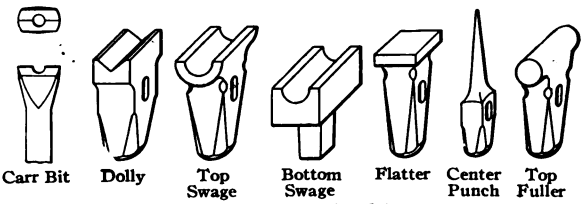
This set of tools will dress bits up to 2½″ diameter, which covers the general run of work. Dollies for 3″ bits can be furnished but they are special and not carried in stock.

NOTE—The center punch is furnished in these sets only with tools for dressing hollow steels It will not be included in the set unless the order specifies for "dressing hollow steel". Dollies with pins are not furnished.

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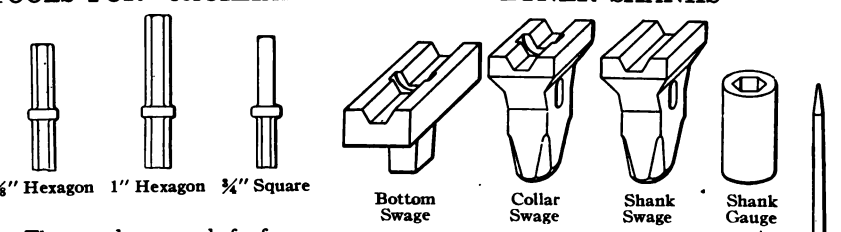
Hand Blacksmith Tools

TOOLS FOR CARR BITS



With the exception of the dolly, the tools necessary to form Carr bits will be found in the equipment of most blacksmiths. Make sure that the top swage, bottom swage and top fuller in his set are proper size as given in the list. If they are not, then the proper tools should be included with the order for dollies. Carr bit dollies are made only in one size, 2⅛" face.

TOOLS FOR "JACKHAMER" AND 26 LEYNER SHANKS



These tools are made for forming "Jackhamer" shanks as follows:

⅞" Hexagon Shanks 3¼" long on ⅞" Hexagon Steel.

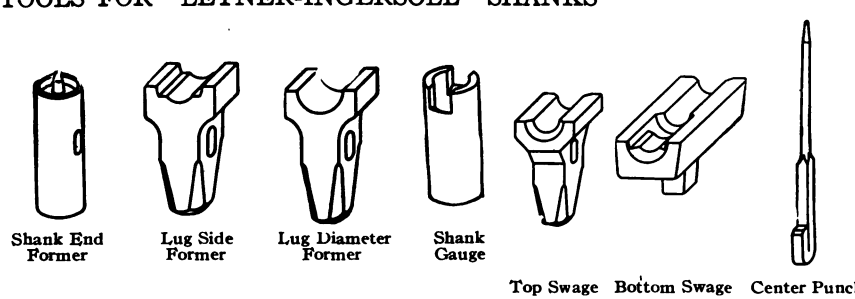
1" Hexagon Shanks 4¼" long on 1" Hexagon Steel.

¾" Square Shanks 3¼" long on ⅞" Round Steel.

Square shanks on round steel are the standard in Europe. This style shank is troublesome to make and its use should be discouraged. It is never used in domestic machines.

The method of using these shank forming tools is clearly shown on hanger 765.

TOOLS FOR "LEYNER-INGERSOLL" SHANKS



These tools are made for forming shanks on 1⅛" diameter and 1¼" diameter steel. When ordering these sets, always specify the size of steel to be used.

Bulletin 9025

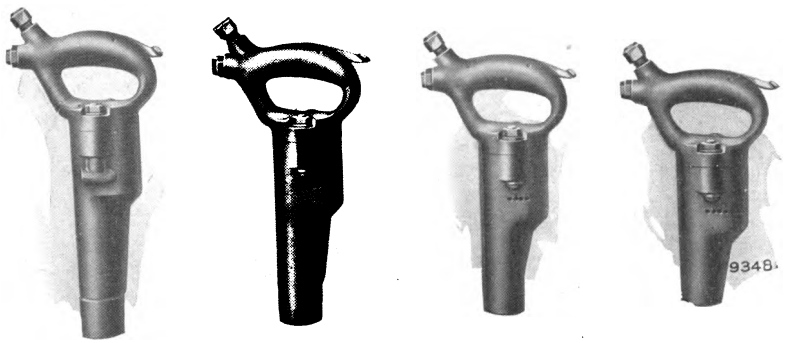
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"Little David" Chipping, Calking and Scaling Hammers



"Little David" Chippers No. 4S, 3S, 2S and 1S

The "Little David" Chipping and Calking Hammers were designed to overcome troublesome features common to other makes of hammers. They represent a complete departure from past practice and embody features which appeal at once to users of pneumatic tools.

"Little David" Chipping Hammers are made in eight sizes, six of which have the novel "Little David" valve, and are suitable for chipping, calking, beading and heavy scaling. The other two sizes, "N-O" and "N-1" are valveless tools for very light chipping and scaling purposes and are further described on following page.

The "Little David" valve and valve chamber are offset from the piston bore eliminating any opportunity for the piston to injure the valve and greatly reducing the over-all length of the tool, permitting its use in close quarters. The throttle valve is a combination piston and poppet type, which insures against wear and leakage, and gives a very sensitive throttle control. The "Little David" may easily be taken apart for inspection and cleaning, with the aid of a wrench. The handle is attached to the barrel by two special alloy steel bolts of substantial size, fitted with lock washers. Standard equipment includes one Hose Nipple.

Shanks furnished on Chisel Blanks are either hexagon or round as ordered. When differential shanks are required with tools equipped with Hexagon bushing, they must be specially ordered. Bulletin 8413.

Size No.	Piston Stroke Inches	Length over-all Inches	Weight Lbs.	Size Hose Recommended Inches
1S	1	11¼	11¾	½
2S	2	12¼	12¾	½
2SS	2	12¼	12¼	½
3S	3	13¼	13	½
4S	4	14¼	13¾	½
5	4	14½	14¼	½

NOTE—The only difference between a No. 4-S and No. 5 is in the nozzle. The No. 4-S takes the standard chisels and the No. 5 a larger chisel.

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"Little David" Type "N-0" and "N-1" Scaling Hammers



The "Little David" type "N-0" and "N-1" Hammers are designed for very light chipping and calking and for scaling paint and rust from metal. They are used extensively in shipyards for scaling ships.

Being designed for very light, rapid blows, this tool differs considerably in construction from the types described on preceding page. The tool is valveless, so that there is but a single moving part in the barrel of the tool—the piston.

The sandblast finished handle and single lever throttle control are similar to those in the larger sizes. The barrel is polished, which finish has been found thoroughly serviceable for such small tools. Screwed and bolted construction for securing the handle and barrel has proven very satisfactory for the light service under which they operate. Bulletin 8413.

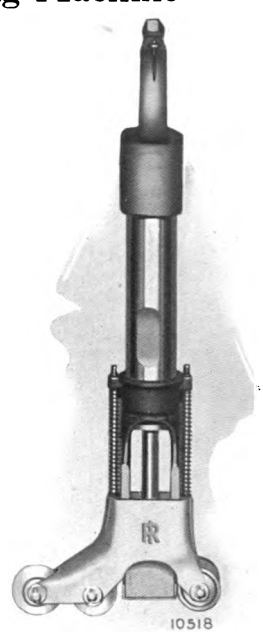
Size No.	Piston Stroke Inches	Length Over-all Inches	Weight Pounds	Size Hose Connection Inches	Size Hose Recommended Inches
N-0	1¼	10⅝	6¼	¼	½
N-1	1¼	10⅝	7	¼	½

"Little David" No. 23 Calking Machine

The No. 23 "Little David" Calking Machine is a compressed air operated tool for calking machine or hand spun oakum or cotton for final horsing, at the rate of 1500 tacks per minute, without skill or experience on the part of the operator. It does the work of ten hand workers and is equally efficient. In a test recently conducted, 35 feet of seam on deck were completed in 3½ minutes or almost ten times as much as can be accomplished by hand work in the same length of time.

The No. 23 Calking Machine has only six major parts, all as strong and sturdy as is consistent with their weight and calculated to withstand strains far beyond the capacity of the machine. The major parts consist of the Carriage, Guide, Barrel, Piston with Calking Iron, Valve Mechanism and the handle.

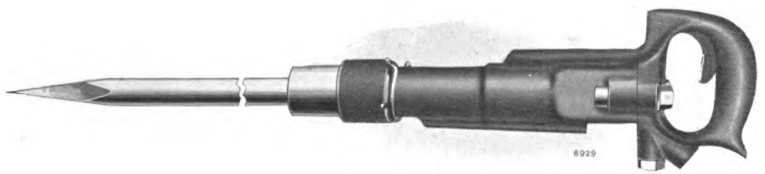
Bulletin 8015.



Size No.	Weight of Complete Machine—Lbs.	Length Overall Inches	Speed Tacks per Minute
23	13½	22	1500

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"Little David" Coal Picks and Corebreakers



Type "MP-1" "Little David" Coal Pick and Corebreaker

The "Little David" Type "MP-1" Coal Pick and Corebreaker is a light, high speed, valveless tool of extremely simple construction, being able to stand considerable abuse and not easily affected by dust or dirt. It is used for foundry work such as breaking out cores from castings or cutting out block or brick paving, or demolishing of masonry structures, for stripping and picking coal in the coal mines and work of a similar nature. In fact it can be used for the same purposes as the 56H Coal Pick described on page 28 of the Rock Drill section of this catalog only that it strikes a lighter and quicker blow.

It is a simply constructed tool with only one moving part, the piston. It has the standard "Little David" bolted construction between the handle and barrel, which latter parts are drop forgings. All wearing parts of the tool are hardened and ground. The steel or pick is held in the hammer by a retaining spring, but can easily be removed at the will of the operator. Low air consumption is another feature to recommend this tool.

Bulletin 8312.

Size No.	Piston Stroke Inches	Piston Diameter Inches	Length Exclusive of Chisel	Size of Hose Inches
MP-1	2½	1 11/16	18	½
56H	3½	1¼	19¾	½

Standard Equipment

MP-1—One ½-inch Hose Nipple. Accessories when specified, one wrench, No. 27.

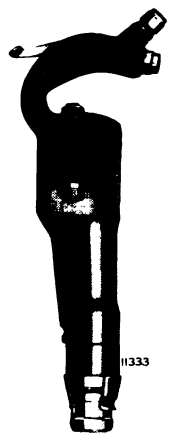
Chisel Blanks

Shanks are .869 ins. in diameter by 2¾ ins. long with a collar 1⅝ ins. in diameter by ⅜ ins. thick. Either round or hexagon shank can be furnished.

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"Little David" Riveting Hammers







No. 80, 50 and 60 "Little David" Riveters

The superiority of "Little David" Riveting Hammers is acquired through many original and advantageous features not found in any similar tools on the market. They are powerful, easy to operate and have extremely low maintenance costs. They are offered in six different sizes.

The open type handle is standard on all except the No. 5 and No. 40 sizes, but inverted type handles, closed type inside trigger or closed type outside trigger handles can be furnished. The No. 5 and No. 40 are regularly fitted with a closed type handle with outside trigger but can be supplied with an open type outside trigger handle.

The handle and barrel are two drop forgings, double heat treated, and sand-blast finished on the outside, overcoming hand slippage.

The handle is attached to the barrel by two alloy steel bolts of substantial size, fitted with lock washers.

The valve is parallel to, but not in line with the piston; this considerably shortens the tool permitting its use in close quarters and also eliminates all opportunity for the piston to injure the valve. There are but two parts to the valve mechanism; the valve and its guide.

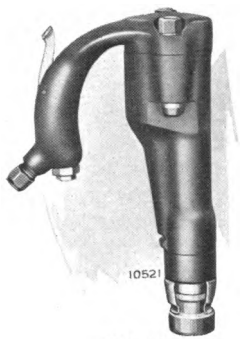
The throttle is a combination of piston and poppet type, which insures against wear and leakage and gives a very sensitive throttle control.

The "Little David" may easily be taken apart for inspection and cleaning.

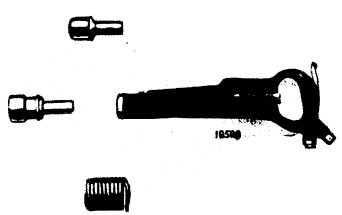
Bulletin 8611.

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"Little David" Riveting Hammers



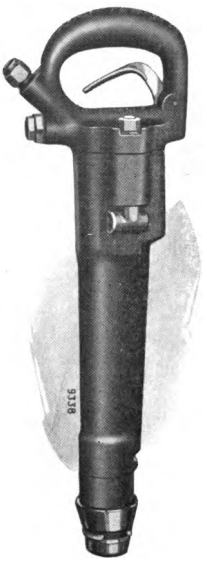
Riveter with Inverted Handle



Rivet Set Retainer



No. 80 Riveter with closed handle, set retainer and special set



No. 90 Riveter with Inside Trigger Handle

Numerous attachments have been devised to prevent the rivet set from being accidentally shot out. The one illustrated is an exclusive feature of the "Little David" hammers, and is the simplest and most efficient device ever invented. It positively prevents the rivet set or piston from being accidentally driven out.

The retainer is made of heavy extra strong spring steel wire closely wound so as to be a snug fit around the outside of the barrel. One end is looped to fit a notch in the barrel, positively holding the retainer in place. The other end is wound in such a manner that the rivet set, if 7/8 inch or smaller, is held in place by a shoulder on the set, while the larger sets are held in place by a thread. Bulletin 8611.

Size No.	Piston Stroke Inches	Piston Diam. Inches	Length Exclusive of Set	Standard Piston Inches	Weight (Without Set) Lbs.	Size of Hose Recommended Inches	Rivet Set Shanks	Over-all Length With Inverted Handle
5	4	1 1/8	14 3/8	3	14	1/2	.871" x 2 3/4"	—
40	4	1 1/8	14 3/4	2 1/2	14 1/4	1/2	1.2165	—
50	5	1 1/16	16 1/4	2 1/2	18	1/2	Inches	12
60	6	1 1/16	17 1/4	3	20	1/2	diam. by	14
80	8	1 1/16	19 3/4	3	22	1/2	2 3/4 ins.	16 1/4
90	8	1 15/64	19 3/4	3 1/2	24 1/2	1/2	long	16 1/4

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"Little David" Jam Riveter

The "Little David" Jam Riveter is an exceptionally valuable tool for working in close quarters, as between flanges of beams and columns, on the inside of boilers, or for any work in cramped spaces.



"Little David" Jam Riveter Size 0 for rivets up to 1⅛ inch diameter

Its length is less than that of any other similar tool of equal capacity.

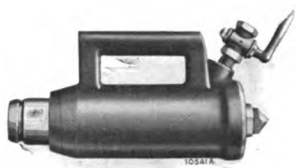
The tool is very simple in design and strongly made to withstand the most severe usage. It is easy to handle and operate, and strikes a heavy blow.

The center may be removed if desired, and a 1 inch pipe screwed in, lengthening the jam riveter so that it will brace between points that are too far apart for the usual arrangement. The pneumatic feed which brings the set up to the rivet has a movement of three inches.

Size No.	Piston Stroke Inches	Piston Diam. Inches	Length Exclusive of Set	Standard Piston	Weight Without Set—Lbs.	Size of Hose Recommended Inches	Rivet Set Shanks
0	4	1¾	11⅞	2½	31	½	1.2165" diam. by 2¾" long



No. 2 "Little David" Holder-On. Suitable for any size rivets



No. 4 "Little David" Holder-On. Suitable for any size rivets



No. 5 "Little David" Holder-On. Suitable for any size rivets

The "Little David" Holder-on is designed to take the place of the ordinary dolly bar used to back up rivets. Its small size and lightness permits its use in confined places, where backing up with the dolly bar is attended by great difficulties. It does away with the numerous makeshifts commonly used in riveting work.

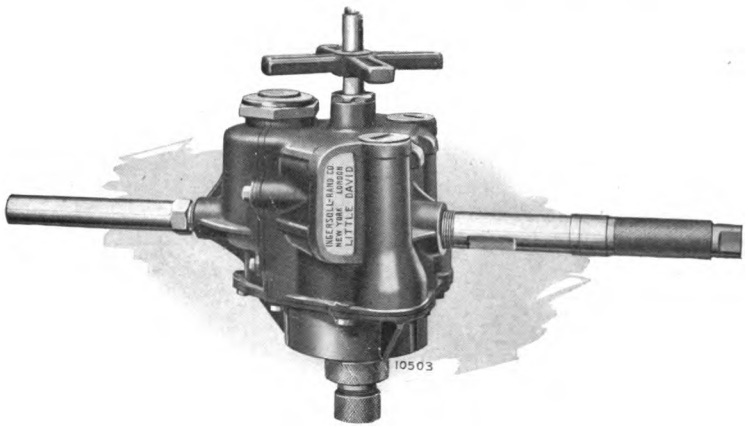
Vibrations are absorbed by the pneumatic cushioning arrangement, relieving the operator of all strain. While the holder-on employs the pressure of the air, it uses very little air, and is decidedly economical as compared with the present growing tendency to employ two hammers. It readily holds up rivets against the hardest blow of the riveter, insuring a strongly riveted joint with completely filled rivet holes.

The "Little David" is simplicity itself, consisting of but eleven parts. Material and workmanship are of the same high quality as the "Little David" Riveting Hammers. **Bulletin 8611.**

Size No.	Piston Stroke Inches	Piston Diam. Inches	Length Exclusive of Set	Weight without Set Lbs.	Size of Hose Recommended Inches	Rivet Set Shanks	Length Closed Inches	Length Open Inches	Distance from Side to Center of Rivet Set
2	3	3⅛	7¼	13½	½	1.2165 Inches	9	12	1¼
4	4½	3⅛	12¼	26	½	dia. by	14½	18½	1⅝
5	4½	3⅛	12¼	25	½	2¾"long	14½	17½	1⅝

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"Little David" Pneumatic Drills



Non-Reversible Type

The "Little David" drill embodies many features of construction not contained in any other make of machine, which appeal particularly to the user and the repair man. It is more durable and efficient, cheaper to keep in repair, will stand a greater overload without stalling and contains many less parts than any other drill on the market.

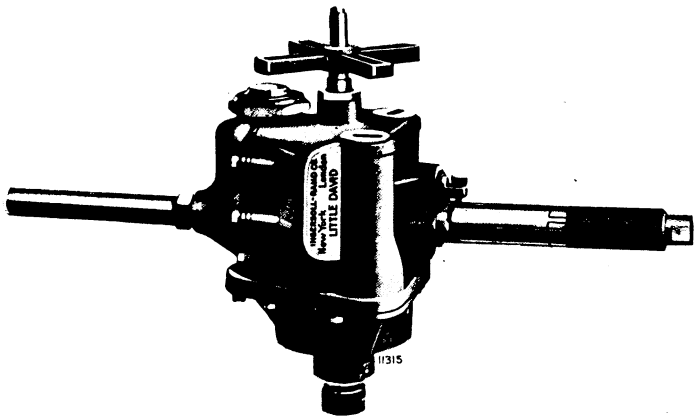
It is adapted in its various sizes, for all the work of the pneumatic drill; drilling, reaming, tapping, flue rolling, wood boring, stud setting, bolt tightening, running down screw spikes, setting valves, etc. Bulletin 8807.

"LITTLE DAVID" NON-REVERSIBLE DRILLS

Size No.	Average Free Speed 90 lbs. Pressure R.P.M.	Weight Lbs.	Length of Feed Inches	Reaming Inches	Tapping Inches	Standard Twist Drill will Drive	Length over-all Inches	Morse Taper Socket	Hose Inches	Distance from Side to Center of Spindle
1B	240	55	5½	2	2	2¼	16	4	¾	4⅜
1C	210	55	5½	2½	2½	3	16	4	¾	4⅜
1SE	100	68	5½	Extra Heavy Drilling, Reaming and Tapping			19⅛	5	¾	4⅜
2	450	41	4⅞	1	1	1¼	14½	3	¾	3⅝
2S	450	43	4⅞	1	1	1¼	15	4	¾	3⅝
2SC	310	43	4⅞	1¼	1¼	1½	15	4	¾	3⅝
3	700	24	4⅜	¾	¾	29/32	11¾	2	¾	3
3S	700	25	4⅜	¾	¾	29/32	12½	3	¾	3
3SB	325	27	4⅜	1	1	1¼	13⅝	3	¾	3
3SC	220	27	4⅜	1	1	1¼	13⅞	3	¾	3
3AA	900	24	4⅜	¾	¾	29/32	11¾	2	¾	3
3SAA	900	25	4⅜	¾	¾	29/32	12½	3	¾	3
5	900	15	2½			⅝–9/16	14¾	1	½	1½
5A	1500	15	2½			½	14¾	1	½	1½
44	1400-3000	9				5/16 Chuck	14⅝		½	2⅞
6	2000	9				⅜	13⅞	1	½	15/32
600	2000	11½				⅜	15	1	½	1⅝
"LITTLE DAVID" CLOSE QUARTER DRILLS										
9	170	39	3¾	2	2	3	9	4	¾	1⅝
8	200	32	2⅝	1¼	1¼	1¼	8	3	¾	1⅜
"LITTLE DAVID" GRINDERS										
			Diameter of Wheel-end of crank shaft							
7	3000	22	⅝"				20½		¾	3¼
601	4200	14	½"				18⅝		½	2⅝
602	4200	14	½"				19⅞		½	2⅝
"LITTLE DAVID" SAW										
7	3000	22	Diameter of Saw-end of crank shaft ⅝"				26½		¾	3¼

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"Little David" Pneumatic Drills



Reversible Type

The motor is of the right angle four-cylinder, single acting, reciprocating piston type, each pair of pistons being attached to opposite throws of a double crank shaft, insuring good balance and a strong steady torque. "Little David" Drills are fitted with a telescopic feed which gives them the largest possible range while making them absolutely safe when the farthest limit is reached.

The line comprises simple and compound geared types of drill and can be had either reversible or non-reversible.

With the exception of the valve bushings, which are bronze, all parts subject to wear or strain are made of selected steel, hardened and ground to close working fits, and so designed as to reduce friction to a minimum, and to secure ample strength with the utmost lightness. Superior workmanship throughout, together with the use of limit gauges, jigs and templets, assure absolute interchangeability. Bulletin 8807.

"LITTLE DAVID" REVERSIBLE DRILLS

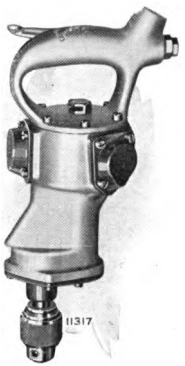
Size No.	Average Free Speed 90 lbs. Pressure R.P.M.	Weight Lbs.	Length of Feed Inches	Reaming Inches	Tapping Inches	Flue Rolling Inches	Standard Twist Drill will Drive	Length over-all Inches	Morse Taper Socket	Hose Inches	Distance from Side to Center of Spindle
11B	240	60	5½	2	2	3½	2¼	16	4	¾	4⅜
11C	210	60	5½	2½	2½	4	3	16	4	¾	4⅜
11SE	100	73	5½	Extra Heavy Reaming, Tapping and Flue Rolling				19⅛	5	¾	4⅜
22	450	42	4⅞	1	1	2½	1¼	14½	3	¾	3⅝
22S	450	45	4⅞	1	1	2¼	1¼	15	4	¾	3⅝
22SC	310	45	4⅞	1¼	1¼	3	1½	15	4	¾	3⅝
33	725	25	4⅜	¾	¾		29/32	11¾	2	½	3
33S	725	26	4⅜	¾	¾		29/32	12½	3	½	3
33SC	225	28	4⅜	1	1		1¼	13⅝	3	½	3

"LITTLE DAVID" WOOD BORERS

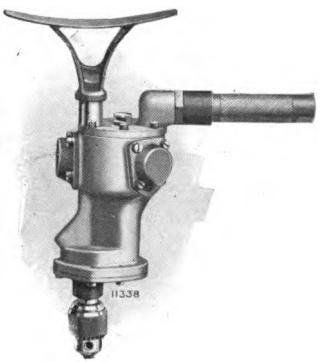
Size No.	Average Free Speed 90 lbs. Pressure R. P. M.	Weight Lbs.	Size of Wood Bit will drive	Length over-all Inches	Hose Inches	Distance from Side to Center of Spindle
22WB	440	42	4	17⅝	¾	3⅝
13	900	20	2	15¾	½	3
15	900	15	1	14½	½	1½
15A	1500	15	⅞	14½	½	1½

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"Little David" Pneumatic Drills



"Little David" Drill No. 6



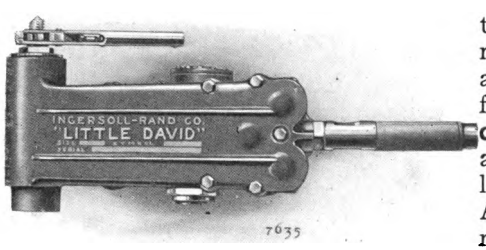
'Little David" Drill No. 600

These drills have been designed to satisfy the demand for light weight, high speed machines which will drill small holes rapidly without breakage of twist drills. They are especially adapted to the automobile industry, but are well suited for any drilling up to and including 3/8 inch.

The motor is similar to the No. 7 Grinder described on opposite page. The case is aluminum with cylinders of separate iron castings, easily accessible, renewable and interchangeable. The No. 600 drill is the same as the No. 6 except the grip handle is replaced with a case cover, breast plate and a rolling drill throttle handle.

For dimensions, capacities, etc. see page 7. Bulletin 8807.

"Little David" Pneumatic Close Quarter Drill

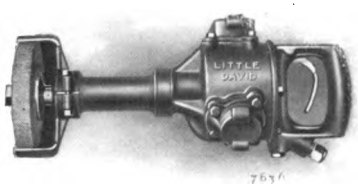


The "Little David" Close Quarter Drills are specially designed machines for close quarter work, and have many unique and superior features. The motor is of the 3-cylinder type with pistons acting at right angles to the 3 rocking levers which operate the spindle. A very steady continuous movement of the spindle is obtained as one ratchet pawl is always in contact with a tooth of the spindle, an exclusive feature of "Little David" design. The construction is very simple and rugged, with one-half the number of parts of any similar tool. The case is in two parts so that the whole mechanism is easy accessible for inspection. All parts are made of the best material, heat treated, and ground where necessary to close fits. The air consumption per H.P. is very low, but the drills will take a greater load before stalling than any other make of corresponding size.

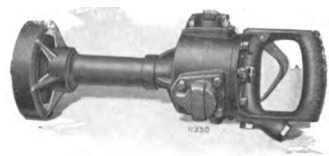
For dimensions, capacities, etc. see table on page 7. Bulletin 8807.

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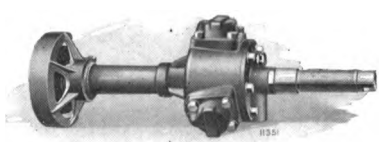
"Little David" Pneumatic Portable Grinders and Saw



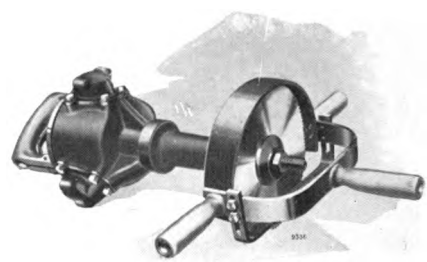
No. 7 "Little David" Grinder



No. 601 "Little David" Grinder



No. 602 "Little David" Grinder



No. 7 "Little David" Pneumatic Saw

"Little David" Grinders are available in two different sizes, a large size No. 7 suitable for the heavier class of buffing, polishing and grinding, and a small size in two styles known as No. 601 and 602. The latter are lighter, higher speed machines, with two styles of handle equipment. The 601 has a closed type inside trigger handle similar to the No. 7 while the No. 602 has a rolling throttle handle such as used on the non-reversible drills.

"Little David" Grinders all have a three cylinder motor of unique construction, marked by great simplicity, accessibility and ruggedness. They have 30 per cent less parts than any other Grinder now on the market and are exceptionally powerful and durable.

The No. 7 Grinder can also be furnished mounted on a stationary pedestal.

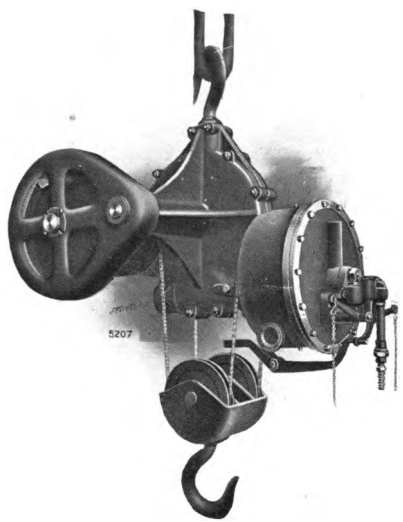
The "Little David" pneumatic saw is similar in design and construction to the No. 7 Grinder. It is an extremely, handy tool for timber work, being used for sawing off corners, grooving for strap irons, matching timbers and a great many other jobs which prove laborious and require considerable time to do by hand.

For dimensions, capacities, etc. see table on page 7.

Bulletin 8807.

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"Little David" Motor Hoists



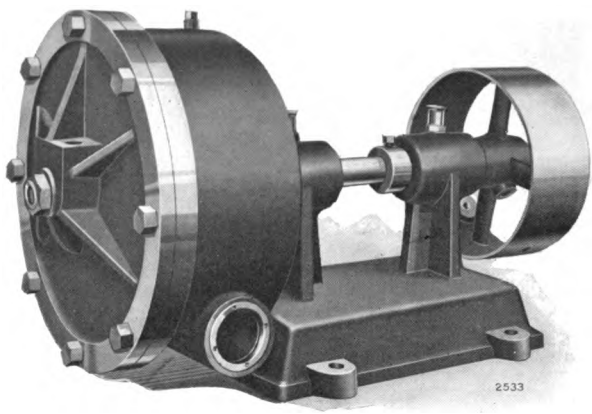
The "Little David" Hoist is offered in five sizes, from one-half to five tons capacity, with a standard lift of twenty feet. It is entirely enclosed and dust proof. Every bearing is fitted with renewable bushings and operates in an oil bath. The worm gearing affords an automatic lock in any position without the use of a brake. The "Little David" has no vibration at any speed, adapting it peculiarly to problems of delicate hoisting where a jar, jerk or vibration would result disastrously. Its labor-saving qualities have won a general recognition in shops, garages, foundries, warehouses, stone yards, monumental works, ice plants, etc., where rapid and economical handling of work and materials is essential.

Bulletin 8206.

Size No.	Capacity Lbs.	Feet Lift per Min. 80 lbs. Pressure	Maximum Lift Feet	Size and Length Wire Rope	Net Weight Lbs.
1	1000	32	20	1/4"x41'- 0"	270
2	2000	16	20	1/4"x41'- 0"	280
4	4000	8	20	5/16"x41'-10"	395
7	7000	8	20	3/8"x96'- 6"	785
10	10000	7	20	3/8"x96'- 6"	785

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"Little David" Air Motors



The "Little David" Air Motor is really the motor from the "Little David" Hoist, mounted on a sub-base or bed. It is made in two sizes, which are furnished either reversible or non-reversible. It has found useful application for isolated and intermittent service in such work as the operating of small tools or cranes in shops, garages, foundries, freight yards, warehouses, stone yards and quarries; the driving of small chain or rope drums and winches; emery, buffing and polishing wheels; fans, short lines of shafting; operating turntables, boring bars, and locomotive valve setting machines. Its advantages recommend it above all others for plants where compressed air is available. It is powerful, compact, simple and economical, and requires the minimum of attention.

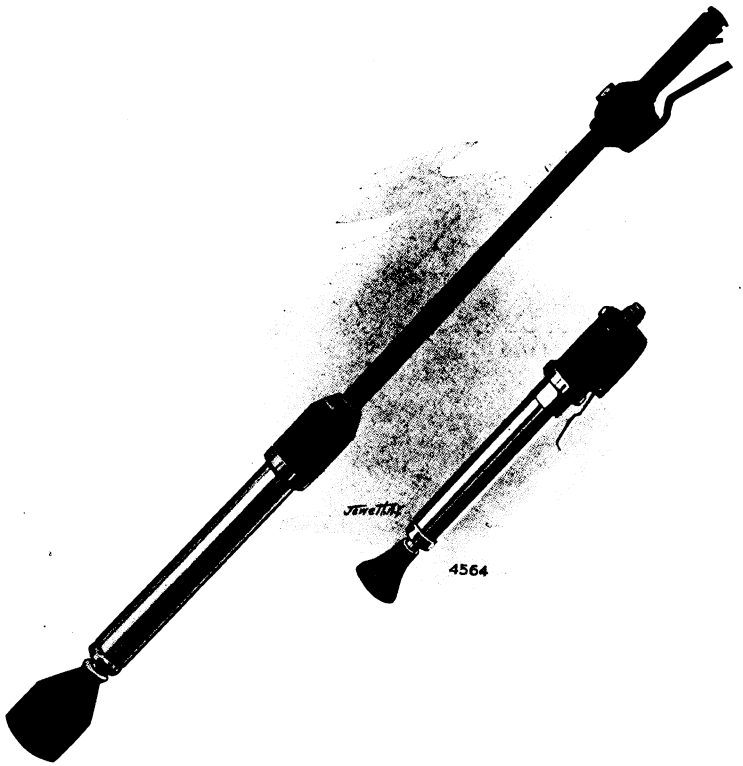
It is to be clearly understood that the "Little David" Motor cannot be used with steam, nor it is intended for continuous service. While the design is entirely adequate for high-duty intermittent operation, the small dimensions do not permit of the mechanical details demanded for continuous operation.

Bulletin 8206.

Size	H. P. 90 lbs. Air Pressure	Speed at Full Load	Free Speed	Weight Lbs.
No. 4 Reversible	1.8	600	1500	129
No. 4 Non-Reversible	2.4	800	1725	129
No. 10 Reversible	2.2	460	1050	230
No. 10 Non-Reversible	4.1	750	1600	210

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"Little David" Sand Rammers



These Rammers have attained an unequaled reputation due to a valve mechanism which not only produces an unusually smooth and powerful action but is peculiarly adapted to the severe conditions of foundry service. They have made a permanent and enviable place for themselves among labor saving devices, on the grounds of economy, larger output and improved quality of finished product which follows, as well as lower costs.

The price of a complete rammer covers the tool bare including the throttle, one round butt and if tool is fitted with flat rod, one pein. The two latter parts fit on the piston rod on a taper. The complete specifications of the "Little David" Bench and Floor Rammers are given below.

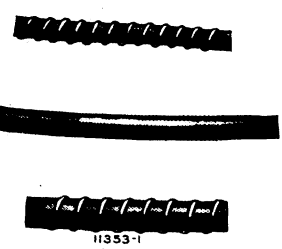
Bulletin 8608.

Size No.	Cylinder Bore Inches	Piston Stroke Inches	Size of Butt Inches	Size of Pein Inches	Weight Lbs.	Length over-all Inches
230 Bench Rammer	1	3¾	2½ diam.	¾" x 2	11 lbs.	17¾
12 Bench Rammer	1	4	2½ diam.	¾" x 2	13 lbs.	21
22 Floor Rammer	1¼	5	3 diam.	¾" x 3	22 lbs.	48

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Pneumatic Tool Accessories

PNEUMATIC TOOL HOSE



The Company furnishes a special brand of superior hose, known as "Antipeel", manufactured expressly for pneumatic tool service. It is a reliable hose which will stand up under the severe use encountered in pneumatic tool work. Internally the hose must withstand the action of moisture and oil without disintegrating, while the outside must resist the wear due to dragging over rough surfaces and through oil and grease. The hose can be supplied either in the plain style or with the wire winding in sizes with an inside diameter of ½", ¾" or 1".

"LITTLE DAVID" HOSE COUPLINGS



Style FO **Style FH** **Style MH** **Style MO**

An improved hose coupling, known as the "Little David" Coupling is now offered for use in connection with pneumatic tool service. It is a simple and sturdy coupling, able to stand lots of wear and abuse without affecting its service. It is quick acting and will not jam, stick or become leaky even under severe working conditions. It consists of two parts, known as male and female which may be connected or disconnected by making a quarter turn as the two halves are pushed together. The Couplings are made in ½ in. and ¾ in. sizes, which are interchangeable; that is, a ½ in. male end may be used with a ¾ in. female end or vice versa. The gaskets are also interchangeable between the different sizes.

"Little David" Hose Couplings are available in the sizes and styles given below.

Style F. O. is an Outside Thread Female Pipe End and screws into the pipe connection. It is made in the following sizes: ½ in. and ¾ in. standard pipe thread. Mention in your order style letters and size. Example:—½ in. F. O.

Style F. H. is a Female Hose End with spiral ribbed shank to insert into hose and is provided with a groove for "Neverslip" Hose Clamp. It is made in ½ in. and ¾ in. sizes. (Inside diameter of the hose.) Mention in your order style letters and size.

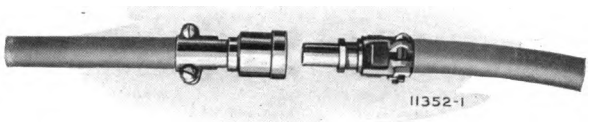
Style M. H. is a Male Hose End with spiral ribbed shank to insert into the hose and is provided with a groove for Neverslip Hose Clamp. It is made in ½ in. and ¾ in. (Inside diameter of hose). Mention in your order style letters and size.

Style M. O. is an Outside Thread Male Pipe End and screws into pipe connection. It is made in ½ in. and ¾ in. standard pipe sizes. Mention in your order style letters and size.

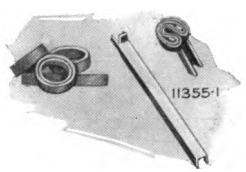
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Pneumatic Tool Accessories

"LITTLE DAVID" HOSE CLAMP



"Little David" Hose Couplings are equipped with a groove to take hose clamp and when fitted with "Little David" clamp will not blow out of the hose. The clamps are sold in pairs, in three sizes, with necessary bolts and nuts, to fit ½ in., ¾ in., or 1 in. hose. Orders should specify the size of hose for which clamps are wanted.

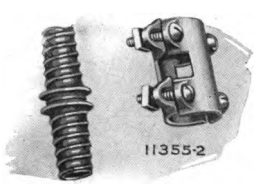


GASKETS and GASKET INSERTING TOOL

Gaskets can be inserted in "Little David" Couplings by means of a wire or lead pencil. However it is much more easily and quickly done by means of our gasket inserting tool and avoids any danger of injuring the gasket.

"LITTLE DAVID" HOSE MENDERS, MENDER CLAMPS & INSERTS

Hose mender inserts and clamps are used for splicing two lengths of hose or repairing broken hose. A very satisfactory, light and permanent connection may be made with these parts. Mender clamps are sold in pairs complete with necessary bolts and nuts. Inserts should be ordered separately. Clamp and inserts are made for ½ in., ¾ in. and 1 in. hose and orders should specify which size is wanted.



HOSE NIPPLES



Hose nipples are made in the following standard sizes:

Hose End	Outside Pipe Thread End	Size of clear air passage
For ⅜" hose	¼" pipe threads	¼"
For ⅜" hose	⅜" pipe threads	¼"
For ½" hose	¼" pipe threads	¼"
For ½" hose	⅜" pipe threads	⅜"
For ¾" hose	½" pipe threads	9/16"

CHUCKS

Square Socket Chucks, Threaded Type for Non-Reversible Drills.

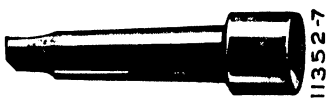


These chucks are made to screw on spindles of "Little David" non-reversible drills for using square shank reamers instead of Morse Taper shanks.

Size of L.D. Drill used with	Chuck—Part No. 342	
	Size of Square Socket	Size of Threaded End of Spindle
2, 2C, 3S, 3SC	⅝"	1⅜" dia., 12 thds. per 1"
1, 2S, 2SC	⅞"	1 11/16" dia., 12 thds. per 1"
1SE	1"	2¼" dia., 12 thds. per 1"

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Pneumatic Tool Accessories







Taper Shank Reamer Chucks—Solid Type.

For use with reversible or non-reversible drills for bits or reamers having square shanks.

Chuck Size	Size of Square Socket	Size Morse Taper
255-3	½"	No. 2
255-2	⅝"	No. 3
255-1	⅞"	No. 4
255-1SE	1"	No. 5

Taper Shank Reamer Chuck with Interchangeable Bushings.

For use with reversible or non-reversible drills. Orders should specify Morse Taper and size of square wanted in bushing.

Size of Square Sockets which can be furnished	Size Morse Taper
½", ⅝", ⅞"	No. 2
½", ⅝", ⅞"	No. 3
½", ⅝", ⅞"	No. 4
1", 1 3/16"	No. 5

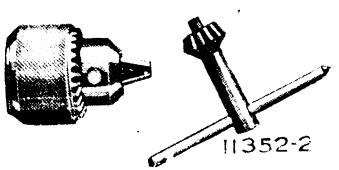
WOOD BIT CHUCKS

For use with wood boring drills. These chucks will take any bit, drill or reamer with ½ in. straight shank.

Part No.	Size of Morse Taper	Size of Round straight shank will take	For use with L. D. Drill No.
51	(Threaded for Spindle .703" dia. 16 threads per 1" No Morse Taper, threaded type—1 set screw	½	15, 15A
143	1—(with 1 set screw)	½"	14
51	2—(with 2 set screws)	½"	13
51	3—(With 2 set screws)	½"	12, 22WB

GEARED CHUCKS

For use on small size drills such as "Little David" No. 5, 6 and 600.



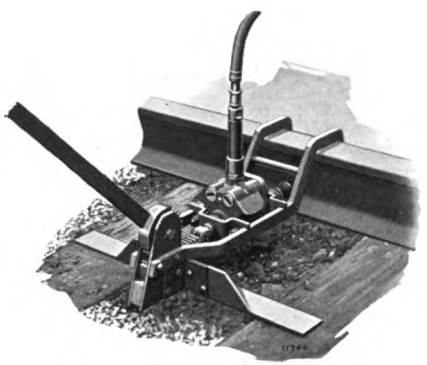
Capacity		
0 to ⅜"	Threaded for Spindle 703" dia. 16 threads per inch With No. 1 Morse Taper Shank	Used on "Little David" Drills No. 5, 6 and 600
0 to ½"		
0 to ⅜"	With No. 2 Morse Taper Shank	
0 to ½"		
0 to ½"		

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Pneumatic Tool Accessories

NO. 5 RAIL BONDING OUTFIT

This Outfit consists of a No. 5 "Little David" drill set in a steel frame or "Old Man" to facilitate its use in drilling bond holes in railroad rails. A lever is provided for quickly bringing the drill up to work. The capacity of this outfit is up to $^{9}/_{16}$ in. dia. holes. It has been found from practical experience that there is a great saving in labor cost of drilling bond holes with this outfit as well as a material saving in the number of twist drills used. With this outfit the same twist drill will drill from five to fifteen times as many holes as in hand drilling.



These outfits are provided with an adjustable plate allowing holes to be drilled various distances from top so that machine is adaptable to any size rail. Where there is considerable of this kind of work to be done this outfit will quickly pay for itself in the saving of labor alone.

"LITTLE DAVID" RAILROAD KIT BOX

These boxes are made from sheet iron substantially bound as shown in the illustration. They are designed to compactly hold a complete set of "Little David" Tools, consisting of various size Drills, Hammers, Corner Drills, "Old Man", Grinders, Grease Gun, Chucks, etc., such as a contractor or railroad company would use in building or repairing bridges, trestles or wherever it is desirable to have a portable outfit which can be securely locked and readily handled.



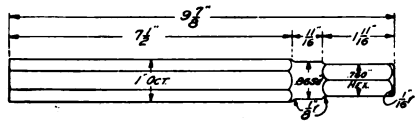
Boxes are sold separately and do not include tools.

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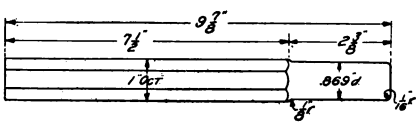
Pneumatic Tool Accessories

CHISEL BLANKS AND CHISELS

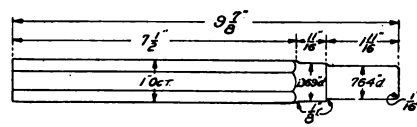
The Company furnishes a complete line of standard chisel blanks, chisels, calking and beading tools for use with "Little David" Chipping, Calking and Scaling Hammers. These are from selected steel and will give the best possible service.



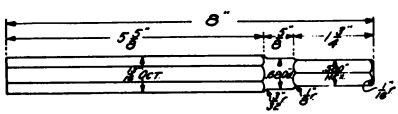
Hexagon Chisel Blank for No. 5 Chipping Hammer



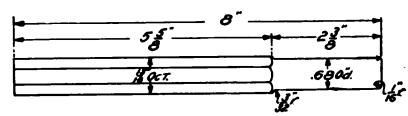
Round Chisel Blank for No. 5 Chipping Hammer



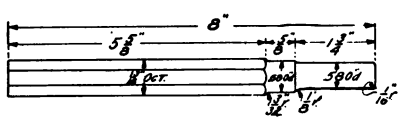
Differential Chisel Blank for No. 5 Chipping Hammer



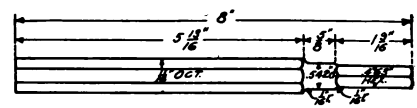
Hexagon Chisel Blank for
No. 1, 2, 3, 4, 1S, 2S, 3S, 4S and N1 Hammers



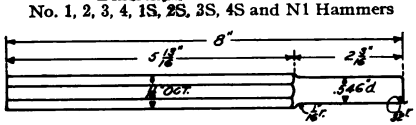
Round Chisel Blank for
No. 1, 2, 3, 4, 1S, 2S, 3S, 4S and N1 Hammers



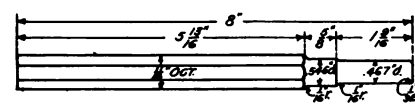
Differential Chisel Blank for
No. 1, 2, 3, 4, 1S, 2S, 3S, 4S and N1 Hammers



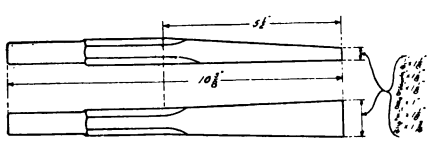
Hexagon Chisel Blank for N0 Hammer



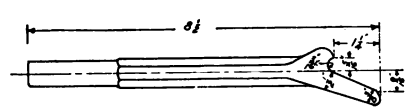
Round Chisel Blank for N0 Hammer



Differential Chisel Blank for N0 Hammer



Lead Caulking Tool—6 in one set
For No. 1, 2, 3, 4, 1S, 2S, 3S, 4S and N1 Hammers

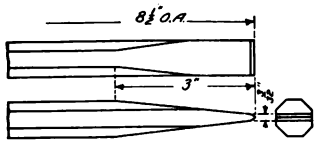


Beading Tool for
No. 1, 2, 3, 4, 1S, 2S, 3S, 4S and N1 Hammers

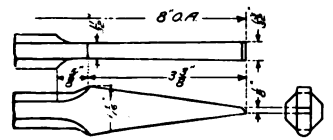
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Pneumatic Tools

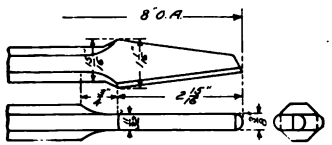
CHISELS BLANKS AND CHISELS



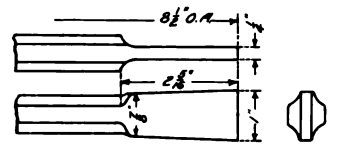
Flat Chisel



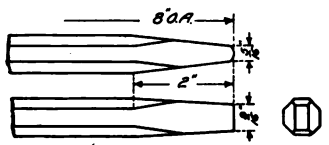
Cape Chisel



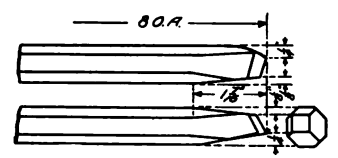
Round Nose Chisel



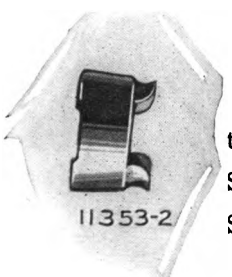
Ripper



Straight Fuller



Diamond Point



RIVET SET CLIPS

For use with "Little David" Riveters are made in two sizes as follows:

Size used on No. 5 Riveter.

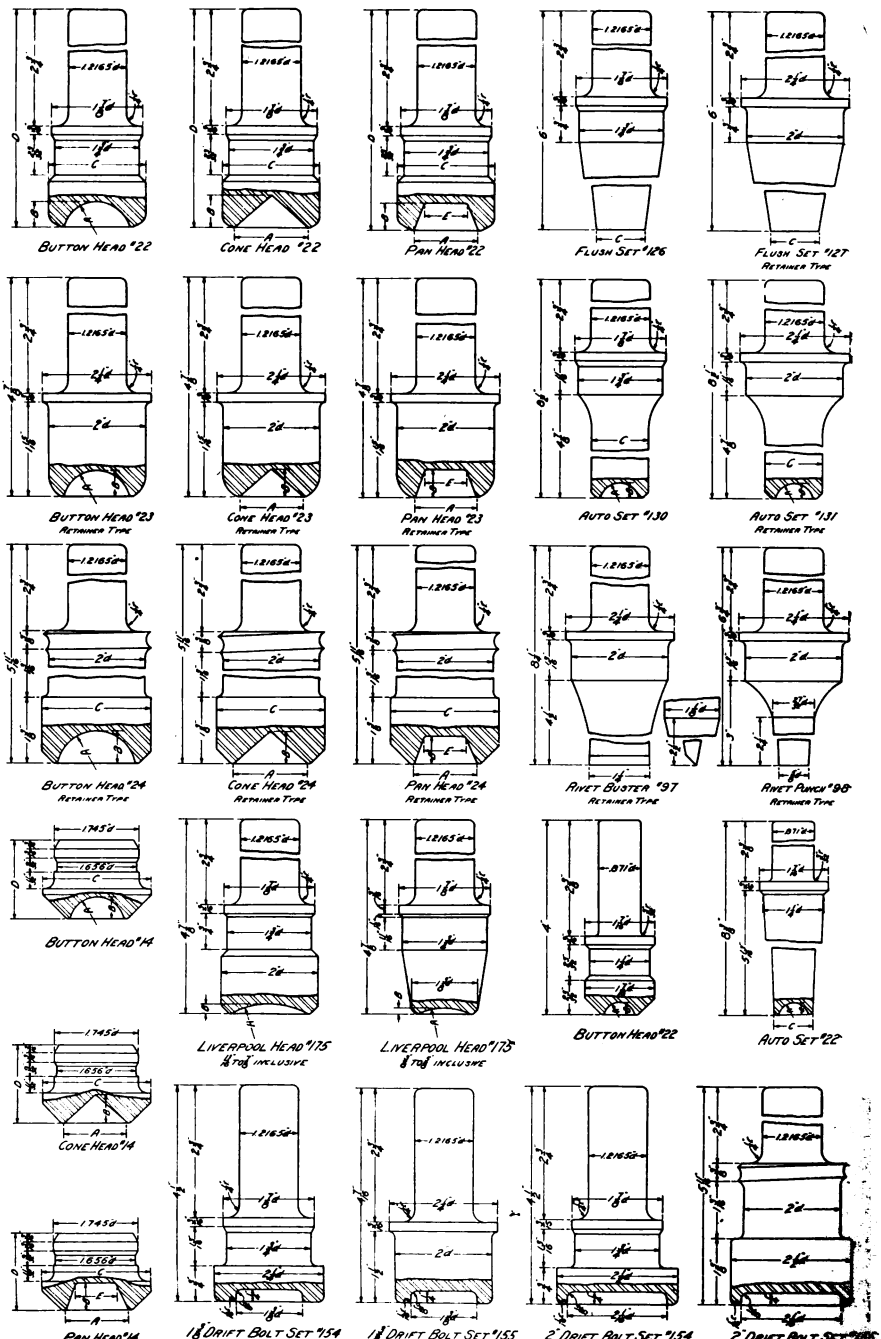
Size used on No. 40, 50, 60, 80 and 90 Riveters.

RIVET SETS, RIVET BUSTERS, ETC.

The severe service to which rivet sets are subjected requires that they be made of the best material and carefully heat treated. The sets offered by this company are all tested and thoroughly inspected before leaving the shop. All steel entering into these sets is carefully analyzed before forging; every possible precaution being taken to maintain a high standard for the product.

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Standard rivet sets, blank or cupped can be furnished as follows.



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"Imperial" Pneumatic Tie Tamping Outfits



A Four Tool "Imperial" Tie Tamping Outfit. Note how the machines are Used in Pairs.

"Imperial" Pneumatic Tie Tamping Outfits for use on both steam and electric railroads were gradually developed under actual working conditions on some of the largest railroad systems in the country. They have now been in use for a number of years and are universally recognized as the standard means to tamp ballast at least cost.

On steam railroads pneumatic tampers are used principally in the operations of laying new track, replacing old track or resurfacing. They are equally as effective in any kind of ballast—stone gravel, earth, cinders, chat, slag, etc.

On electric street railways they are used in new track construction and in renewal and repairs to old tracks and also for breaking up and removing concrete or asphalt paving or picking out paving blocks.

Experience shows that "Imperial" Tampers tamp any kind of ballast effectively; produce a more uniformly tamped track, which is smoother riding; tamp the ballast compactly under the tie, avoiding the formation of water pockets and reducing subsequent settlement.

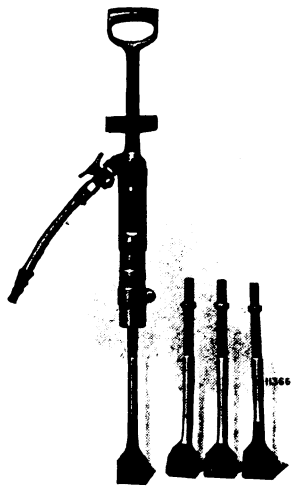
They also tamp around frogs, switches, cross overs, water pans and other places impossible to reach with pick or bar; do not crush or scatter the ballast or sliver the ties and do not tire the workman as much as hand tamping. The cost of track construction and maintenance is greatly reduced. Two men with these pneumatic tampers will tamp more track than eight men with picks and bars.

They have also proved very successful for many special uses such as chopping ice around water pans, breaking out frozen coal, etc.

Catalog 9123.

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"Imperial" Pneumatic Tie Tamping Outfits



"Imperial" Pneumatic Tie Tamper and the Three Styles of Tamping Bars used with it

The "Imperial" Tie Tamper is a percussion hammer arranged with two handles and fitted with a tamping bar which is dressed on the face the same as the hand tamping pick or bar. It is equipped with a retainer for holding the tamping bar in the machine so that it will not drop out when being lifted from one position to another.

ESSENTIAL DETAILS OF PNEUMATIC TAMPER

Weight of machine.....35 lbs.
Weight of machine with throttle connection and tamping bar.....43½ lbs.
Length of machine with bar inserted.....3' 10"
Diameter of air inlet.....½"
Size of hose recommended.....¾"
Best operating air pressure.....65 to 75 lbs.
Air consumption at 70 lbs. pressure.....16 cu. ft. free air per min.
Tamping Bars for different kinds of ballast can be furnished as follows:
Rock ballast, 2" mesh, or larger.....Bar 18" long with ⅝ x 3" face
Rock ballast, finer than 2" mesh, wash gravel and slag.....
.....Bar 18" long with ⅞ x 3" face
Cinders, earth, gravel, sand or chat ballast.. Bar 18" long with 1⅛ x 3" face

A complete tamper consists of one tamping machine with throttle and connections, one tamping bar and one wrench. Tampers are always worked in pairs.

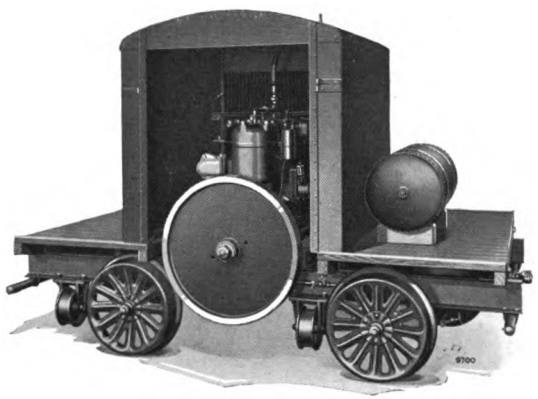
NOTE:—In ordering, style of tamping bar wanted must be specified or the character of ballast must be given.

For work where compressed air is not available, the company furnishes portable compressor cars, gasoline or electric driven, in sizes to operate two or four tampers. These are further described on the following pages.

Catalog 9123.

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"Imperial" Pneumatic Tie Tamping Outfits



Gasoline Engine Driven Tie Tamper Compressor Car

The two and four tool outfits consist of a gasoline engine complete with carburetor, ignition system, governor, radiator, water pump and fan. An "Imperial" vertical single stage, water cooled air compressor with automatic valves is direct connected to the gasoline engine. Cooling water for cylinder jackets is supplied from the engine radiator.

The engine and compressor are mounted on a specially constructed car equipped with gasoline tank and air receiver. The car is self propelled through the medium of a lever-controlled clutch on the engine. A powerful set of foot brakes is provided and there are also a set of cross trucks for quickly moving the car from or onto the tracks.

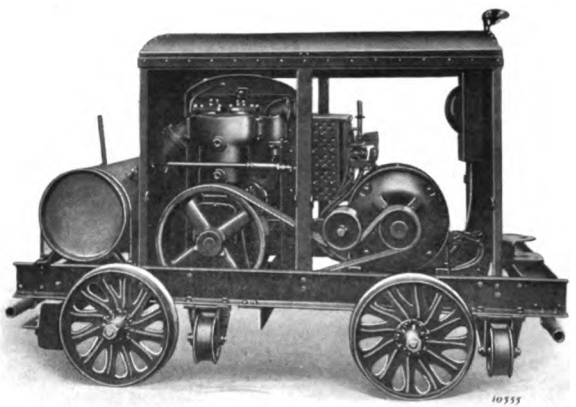
A tool box is also part of the equipment and the entire machinery is enclosed in a removable housing which can be locked to prevent being meddled with. The car is furnished for U. S. Standard broad gauge, 4 feet 8½ inches. It can be supplied for other gauges when specially ordered.

Complete equipment consists of car as described above, one set of wrenches, two or four "Imperial" Tie Tampers fitted with one tamping bar each, style of bar specified; 300 feet of 7-ply Antipeel air hose for each pair of tampers, joined by a tee connection to two 12½′ lengths of hose with suitable connections for attaching to tampers. See page 5.

Catalog 9123.

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"Imperial" Pneumatic Tie Tamping Outfits



Four Tool Electric Motor Driven Tie Tamper Compressor Car

This outfit consists of an "Imperial" duplex, vertical, single stage air compressor, water-cooled and equipped with cooling radiator and fan. The compressor is automatically lubricated by means of a splash system and has automatic air valves. The compressor is connected by a short-belt drive with a high-grade electric motor. A hand starter and switch are furnished.

The motor and compressor are mounted on a specially constructed car equipped with air receiver and fitted with safety valve and pressure gauge. The car is furnished with a draw-bar socket for coupling to a street car and a hand brake. It has transverse wheels for quickly moving the car from or onto the track.

The entire machinery is enclosed in a removable steel housing which can be locked to prevent being meddled with.

Each outfit consists of one car as described above, with a set of wrenches, four "Imperial" Tie Tampers fitted with one tamping bar each (style as specified), and two 300 foot lengths of 7-ply "Antipeel" air hose, (plain). The hose is made up in 50-foot lengths and equipped with "Little David" couplings and each 300 foot length is joined by a tee connection to two 12½-foot lengths, with suitable connections for attaching to the tampers. See page 5 for essential details of compressor cars.

Catalog 9123.

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"Imperial" Pneumatic Tie Tamping Outfits

SPECIAL COMPRESSOR CARS

For service in which a wagon mounted compressor is more adaptable than a hand car unit, the company builds both electric motor and gasoline engine driven portable compressors of various capacities.

For work requiring a compressor of sufficient size to operate a larger number of tampers, more particularly on new track work, the company furnishes gasoline, steam or electrically driven compressors from its standard line, for installation in regular work cars.

The uses of these various compressor cars is not limited to the tamping of ballast as they may also serve to operate different pneumatic tools which can be included in the section gang equipment. The use of such tools greatly facilitates the work of the crew. Some of these uses are described on the following page.

Below are given the essential details of the Two and Four Tool Gasoline Driven Compressor Cars and also of the Four Tool Electric Driven.

ESSENTIAL DETAILS

Weight Complete without Hose or Tampers	Weight Complete with Hose and Tampers	Width	Height	Length	Carrying Capacity	Maximum Traveling Speed M. P. H.	Air Capacity cu. ft. Free Air per Minute	Brake H. P.	Gasoline Tank Capacity Gallons	Gasoline Consumption. Full load. Gals. per hour	Diameter of Wheels M. C. B. Inches
TWO TOOL GASOLINE DRIVEN, SELF-PROPELLED											
2800	3047	5'-7"	5'-6"	9'-9"	12 men and equipment	15	45	12	15	1¼	20"
FOUR TOOL GASOLINE DRIVEN, SELF-PROPELLED											
3300	3794	5'-7"	5'-9"	9'-0"	12 men and equipment	15	88	20	25	2½	20"
FOUR TOOL ELECTRIC DRIVEN, 600 VOLT, D. C. MOTOR											
3500	4085	5'-6"	5'-3"	8'-2"			118	20-25			20"

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"Imperial" Pneumatic Tie Tamping Outfits

"Imperial" Tie Tamper Compressor Units find many applications in the different problems of maintenance besides the tamping of ballast.

The "Imperial" Tamping Tool is of the percussion type construction and when fitted with a bull-point is very effective in breaking concrete up to eight inches in thickness. For removing concrete paving it affords a considerable saving in labor and is also very effective for cutting asphalt, toothing out paving blocks, etc. It has, moreover, been used with great success for breaking frozen coal, ore and stock debris out of cars in winter. It has proved very valuable for chopping ice in and around water pans.

The compressor car is used to operate numerous other pneumatic devices for such purposes as grinding switch points, running down screw spikes, driving cut spikes, woodboring, rock-drilling, riveting, drilling, reaming, sand blast and paint spray.

A very important application of the compressor car has been in drilling rails for bonding. Using this unit and two No. 9 "Little David" Rail Drills, a rate of 1000—⅞ in. holes per day in an 85 pound rail, including delays, has been attained.

Where a lighter bond, such as for signal work, has been required, the No. 5 "Little David" Rail Bonding Drill has been used and 9-32 in. holes bored at the rate of 70 per hour per drill. It has been found from practical experience that there is a great saving in labor cost of drilling with these outfits as well as a decided saving in the number of twist drills used. With this outfit one twist drill will drill from five to fifteen times as many holes as in hand drilling.

The No. 9 "Little David" Drill has also been used in rail laying operations for running on or off the nuts from the angle bar bolts, with remarkable saving over the old hand method.

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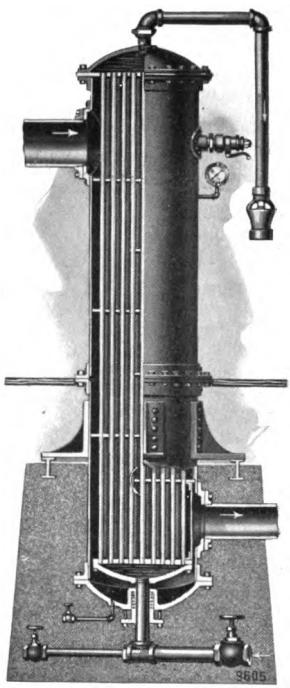
Air Aftercoolers

Air Pressure up to 100 Pounds

Aftercoolers are available in two types, "VK" vertical and "HK" horizontal.

These are similar in general construction to the intercoolers furnished with two-stage Ingersoll-Rand air compressors. The water is passed through a nest of tubes, and the air flows over and around these tubes. In the vertical type the direction of the air flow is counter to the passage of the water. The liberal cooling surface and arrangement of baffles assures the maximum cooling effect of the heated discharge air, causing condensation of the water carried in the air. Necessary safety valves and pressure gauge are furnished. Tube nests are removable and expansion and contraction are fully provided for.

Bulletin 9112.



VK AND HK AIR AFTERCOOLERS
80 to 100 Pounds Air Pressure

No.	Size of Aftercooler		Square Feet of Cooling Surface	Maximum Capacity of Aftercoolers in Cu. Ft. of Free Air per Minute with Cooling Water at							
				60° F.		70° F.		80° F.		90° F.	
	Diam. Shell Inches	Height		Single Stage	Two Stage	Single Stage	Two Stage	Single Stage	Two Stage	Single Stage	Two Stage
VERTICAL IRON TUBE TYPE VK											
2	17½	10′-5″	100	475	640	433	600	390	570	350	550
3	20¾	10′-9″	150	705	960	640	910	575	870	518	836
4	22½	11′-6″	200	925	1270	840	1200	755	1150	680	1100
5	22½	14′-6″	300	1410	1930	1280	1825	1150	1740	1035	1675
6	27¾	14′-6″	500	2340	3210	2120	3030	1910	2900	1720	2780
7	30	17′-11″	750	3500	4820	3180	4550	2880	4350	2590	4180
8	33¼	17′-11″	1000	4650	6370	4220	6020	3800	5760	3420	5520
9	39	19′-3″	1500	6900	9550	6280	9000	5650	8600	5100	8270
10	45¼	19′-9″	2000	9300	12800	8450	12100	7600	11600	6850	11100
HORIZONTAL IRON TUBE—TYPE HK											
1	14	8′-6″	50	253	346	230	330	207	315	186	300
2	17½	10′-6″	100	475	640	433	600	390	570	350	550
3	20¾	10′-6″	150	705	960	640	910	575	870	518	836
4	22½	11′-0″	200	925	1270	840	1200	755	1150	680	1100
5	22½	14′-0″	300	1410	1930	1280	1825	1150	1740	1035	1675
6	27¾	15′-4″	500	2340	3210	2120	3030	1910	2900	1720	2780
7	30	18′-3″	750	3500	4820	3180	4550	2880	4350	2590	4180
8	33¼	19′-4″	1000	4650	6370	4220	6020	3800	5760	3420	5520
9	39	19′-10″	1500	6900	9550	6280	9000	5650	8600	5100	8270
10	45½	19′-10″	2000	9300	12800	8450	12100	7600	11600	6850	11100

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Air Receivers and Moisture Traps



FOR STANDARD WORKING PRESSURES
FOR COMPRESSORS OF SMALL CAPACITY

Number of Size	Diam. Inches	Length Feet	Approx. Contents Cu. Ft.	Approx. Weight Pounds	Diameter Safety Valve Inches	Diameter Inlet and Discharge Openings Inches	Compressor Capacity adapted for Cu. Ft. per Min.
For 110 Lbs. Working Pressure. Tested to 165 Lbs. Water Pressure.							
01	12	3	2¼	70	½	1¼	15
02	14	4	4	100	¾	1½	30
03	16	5	6½	175	¾	2½	50
For 200 Lbs. Working Pressure. Tested to 300 Lbs. Water Pressure.							
04	12	3	2¼	100	½	1¼	15
05	14	4	4	150	¾	1½	30
06	16	5	6½	275	¾	2½	50

FOR COMPRESSORS OF MEDIUM AND LARGE CAPACITY

Number of Size	Diameter Inches	Length Feet	Approx. Contents Cu. Ft.	Approx. Weight Pounds	Diameter Safety Valve—Ins.	Diam. Inlet and Discharge Openings Inches	Compressor Capacity adapted for Cu. Ft. per Min.
For 110 Lbs. Working Pressure. Tested to 165 Lbs. Water Pressure.							
0	18	6	10	350	1	2½	90
00	24	6	18	575	1¼	2½	120
1	30	6	29	950	1½	3	150
2	36	6	42	1000	1½	3½	150 to 200
3	36	8	56	1350	1½	4	200 to 300
4	42	8	77	1750	2	5	300 to 500
5	42	10	96	2000	2	6	500 to 700
5½	48	8	100	2480	2½	6	500 to 800
6	48	12	150	3000	2½	7	700 to 1200
7	54	12	190	3300	2½	8	1200 to 2000
7½	60	14	275	5500	2½	9	2000 to 3000
8	66	18	437	7500	2½	10	3000 and over
9	24	6	18	625	1½	4	These are only furnished horizontal style and are used as water traps in air lines
10	36	6	42	1100	1½	6	
10½	48	8	100	2200	2½	6	

Bulletin 9112

For prices and data on receivers for high pressures or special conditions consult the Company's New York Office.

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Air Reheaters

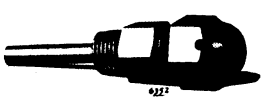
We recommend the use of Reheaters in all plants where the air is to be transmitted long distances, and used out-of-doors. They are particularly essential in cold weather to prevent the freezing of the moisture in the air, and the consequent choking of the exhaust ports of the different tools operated. They should be located as close to the tools as practical, and it is desirable to insulate all hot pipes, to prevent loss of heat by radiation.



As the air passes through the reheater, and is heated to the usual temperature of about 250° Fahr., it expands in volume from 30 to 35 per cent, which increases its working capacity that amount. Bulletin 9102.

Size No.	Overall Dimensions Inches		Square Feet Heating Surface	Inlet and Outlet Diameters Inches	Capacity in Cubic Feet of Free Air per Minute at 80 Pounds Pressure	Final Temp. Degrees Fahrenheit	Percentage Increase in Volume	Net Weight Pounds
	Outside Diameter	Height						
1	17	31	7½	2	200	250	30	400
2	41	60	22	4	550	250	30	2980

Hodges Fusible Signal Plugs



The use of the plug herewith illustrated is an insurance against the development of excessive strains or other unnatural conditions arising from an abnormal rise in temperature in air compressor cylinders, receivers, air lines, etc.

When a rise in temperature, to a predetermined point, occurs in the apparatus protected by it, the safety element is melted out of the plug, giving warning by a distinctive whistle, which will persist until the trouble has been remedied. It is then but a moment's work to replace the plug with a new one and the plant is again protected against a similar recurring danger.

The plug forms a very desirable addition to compressed air equipment and should be found at every point of possible danger throughout the plant.

It is supplied in two types with a 350° and 500° blowing point, respectively.

The 350° plug is suitable for use in the discharge pipe of a single-stage compressor working at 40 pounds gauge pressure, in the discharge side of a two-stage compressor working at 100 pounds gauge pressure or in the discharge side of a three- or four-stage compressor delivering air at 1000 pounds gauge pressure.

The 500° plug is for use in the discharge pipe of a single-stage compressor, working at 100 pounds gauge pressure.

Prices and further information on application. Bulletin No. 9017.

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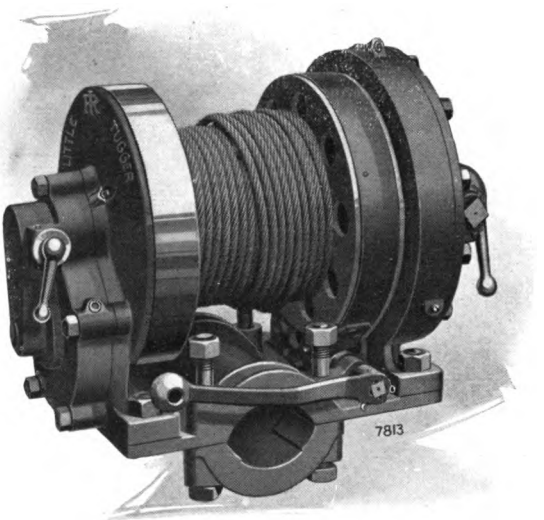
The "Sergeant" Ticket Cancelling Box



The "Sergeant" Ticket Cancelling Box has won almost international application in railway, elevated roads, subway and trolley stations, in ferry houses, amusement resorts and other places where great quantities of tickets must be disposed of without possibility of being used a second time. Tickets once dropped into these boxes cannot be removed until they have passed through the chopper which mutilates them beyond all possibility of further use. It has been the one device which has offered a complete solution of this difficult problem and is an absolute protection against loss through the reissuing of tickets. Bulletin 9010.

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"Little Tugger" Hoists



The "Little Tugger" Hoist is a time and labor saver whose value is unlimited in the mine, shipyard, structural steel work and the manufacturing and power plant.

It is built in two sizes, for operation either by air or steam and can effectively handle loads up to 1,000 pounds.

The general design is very simple and compact. There are no moving parts exposed except the drum, all gears and shafts being covered. Lubrication, both of the engines and shaft bearings is automatic. A powerful hand brake is supplied and the drum is fitted with a removable clutch. When the throttle lever is released the air supply is automatically shut off and the hoist will maintain its load in any position. This makes the "Little Tugger" extremely safe to operate. The base of the hoist is arranged so that it can be bolted to a timber or other convenient place, and by the use of a cap, it may be mounted on a mine column or bar. Bulletin 4333.

	Nos. 1H and 1HS	Nos. 11H and 11HS
Net Work Delivered, Horse Power	2½	2½
Size of Drum, Rope Space, Diameter, Inches	6	7
Size of Drum, between Flanges, Length, Inches	7	17
Depth of Flanges, Inches	3	5
Rope Capacity, Maximum Feet	¼"—700 5/16"—450	⅞"—300
Hoisting Capacity in Pounds, at a rope speed of 85 ft. per min., 80 lbs. air or steam pressure	1000	600
Size of Column Clamp will fit, Inches	4½	4½
Air Connections, Inches	¾	¾
Weight, less Cable or Rope, Unboxed, lbs	285	358
Unboxed Dimensions, Inches		
Length	21¼	31¼
Width	16½	21½
Height	20⅛	23
Shipping Weight, lbs.	362	456

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Horse-Power Required

FOR COMPRESSING ONE CUBIC FOOT OF FREE AIR PER MINUTE (ISOTHERMALLY AND ADIABATICALLY) FROM SEA LEVEL ATMOSPHERIC PRESSURE (14.7 POUNDS) TO VARIOUS GAUGE PRESSURES

Single-Stage Compression—Jacket-Cooling Not Considered

Gauge Pressure Pounds	Absolute Pressure Pounds	Number of Atmospheres	Isothermal Compression		Adiabatic Compression			
			Mean Effective Pressure	H. P.	Mean Effective Pressure Theoretical	Mean Eff. Pressure plus 15% Friction	H. P. Theoretical	H. P. plus 15% Friction
5	19.7	1.34	4.13	0.018	4.46	5.12	0.019	0.022
10	24.7	1.68	7.57	0.033	8.21	9.44	0.036	0.041
15	29.7	2.02	11.02	0.048	11.46	13.17	0.050	0.057
20	34.7	2.36	12.62	0.055	14.30	16.44	0.062	0.071
25	39.7	2.70	14.68	0.064	16.94	19.47	0.074	0.085
30	44.7	3.04	16.30	0.071	19.32	22.21	0.084	0.096
35	49.7	3.38	17.90	0.078	21.50	24.72	0.094	0.108
40	54.7	3.72	19.28	0.084	23.53	27.05	0.103	0.118
45	59.7	4.06	20.65	0.090	25.40	29.21	0.111	0.127
50	64.7	4.40	21.80	0.095	27.23	31.31	0.119	0.136
55	69.7	4.74	22.95	0.100	28.90	33.23	0.126	0.145
60	74.7	5.08	23.90	0.104	30.53	35.10	0.133	0.153
65	79.7	5.42	24.80	0.108	32.10	36.91	0.140	0.161
70	84.7	5.76	25.70	0.112	33.57	38.59	0.146	0.168
75	89.7	6.10	26.62	0.116	35.00	40.25	0.153	0.175
80	94.7	6.44	27.52	0.120	36.36	41.80	0.159	0.182
85	99.7	6.78	28.21	0.123	37.63	43.27	0.164	0.189
90	104.7	7.12	28.93	0.126	38.89	44.71	0.169	0.195
95	109.7	7.46	29.60	0.129	40.11	46.12	0.175	0.201
100	114.7	7.80	30.30	0.132	41.28	47.46	0.180	0.207
110	124.7	8.48	31.42	0.137	43.56	50.09	0.190	0.218
120	134.7	9.16	32.60	0.142	45.69	52.53	0.199	0.229
130	144.7	9.84	33.75	0.147	47.72	54.87	0.208	0.239
140	154.7	10.52	34.67	0.151	49.64	57.08	0.216	0.249
150	164.7	11.20	35.59	0.155	51.47	59.18	0.224	0.258
160	174.7	11.88	36.30	0.158	53.70	61.80	0.234	0.269
170	184.7	12.56	37.20	0.162	55.60	64.00	0.242	0.278
180	194.7	13.24	38.10	0.166	57.20	65.80	0.249	0.286
190	204.7	13.92	38.80	0.169	58.80	67.70	0.256	0.294
200	214 7	14.60	39.50	0.172	60.40	69.50	0.263	0.303

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Horse-Power Required

FOR COMPRESSING ONE CUBIC FOOT OF FREE AIR PER MINUTE (ISOTHERMALLY AND ADIABATICALLY) FROM SEA LEVEL ATMOSPHERIC PRESSURE (14.7 POUNDS) TO VARIOUS GAUGE PRESSURES

Two-Stage Compression
Intercooling back to initial temperatures but Jacket Cooling not considered.

Gauge Pressure Pounds	Absolute Pressure Pounds	No. of Atmospheres	Correct Ratio of Cylinder Volumes	Intercooler Gauge Pressure	Isothermal Compression		Adiabatic Compression				Percentage of Saving over One-stage Comp.
					Mean Eff. Pressure	H. P.	Mean Eff. Pressure Theoretical	Mean Eff. Pressure plus 15% Friction	H.P. Theoretical	H. P. plus 15% Friction	
50	64.7	4.40	2.10	16.2	21.80	0.095	24.30	27.90	0.106	0.123	10.9
60	74.7	5.08	2.25	18.4	23.90	0.104	27.20	31.30	0.118	0.136	11.3
70	84.7	5.76	2.40	20.6	25.70	0.112	29.31	33.71	0.128	0.147	12.3
80	94.7	6.44	2.54	22.7	27.52	0.120	31.44	36.15	0.137	0.158	13.8
90	104.7	7.12	2.67	24.5	28.93	0.126	33.37	38.36	0.145	0.167	14.2
100	114.7	7.80	2.79	26.3	30.30	0.132	35.20	40.48	0.153	0.176	15.0
110	124.7	8.48	2.91	28.1	31.42	0.137	36.82	42.34	0.161	0.185	15.2
120	134.7	9.16	3.03	29.8	32.60	0.142	38.44	44.20	0.168	0.193	15.6
130	144.7	9.84	3.14	31.5	33.75	0.147	39.86	45.83	0.174	0.200	16.3
140	154.7	10.52	3.24	32.9	34.67	0.151	41.28	47.47	0.180	0.207	16.7
150	164.7	11.20	3.35	34.5	35.59	0.155	42.60	48.99	0.186	0.214	16.9
160	174.7	11.88	3.45	36.1	36.30	0.158	43.82	50.39	0.191	0.219	18.4
170	184.7	12.56	3.54	37.3	37.20	0.162	44.93	51.66	0.196	0.225	19.0
180	194.7	13.24	3.64	38.8	38.10	0.166	46.05	52.95	0.201	0.231	19.3
190	204.7	13.92	3.73	40.1	38.80	0.169	47.16	54.22	0.206	0.236	19.5
200	214.7	14.60	3.82	41.4	39.50	0.172	48.18	55.39	0.210	0.241	20.1
210	224.7	15.28	3.91	42.8	30.10	0.174	49.35	56.70	0.216	0.247	
220	234.7	15.96	3.99	44.0	40.70	0.177	50.30	57.70	0.220	0.252	
230	244.7	16.64	4.08	45.3	41.30	0.180	51.30	59.10	0.224	0.257	
240	254.7	17.32	4.17	46.6	41.90	0.183	52.25	60.10	0.228	0.262	
250	264.7	18.00	4.24	47.6	42.70	0.186	52.84	60.76	0.230	0.264	
260	274.7	18.68	4.32	48.8	43.00	0.188	53.85	62.05	0.235	0.270	
270	284.7	19.36	4.40	50.0	43.50	0.190	54.60	62.90	0.238	0.274	
280	294.7	20.04	4.48	51.1	44.00	0.192	55.50	63.85	0.242	0.278	
290	304.7	20.72	4.55	52.2	44.50	0.194	56.20	64.75	0.246	0.282	
300	314.7	21.40	4.63	53.4	45.30	0.197	56.70	65.20	0.247	0.283	
350	364.7	24.80	4.98	58.5	47.30	0.206	60.15	69.16	0.262	0.301	
400	414.7	28.20	5.31	63.3	49.20	0.214	63.19	72.65	0.276	0.317	
450	464.7	31.60	5.61	67.8	51.20	0.223	65.93	75.81	0.287	0.329	
500	514.7	35.01	5.91	72.1	52.70	0.229	68.46	78.72	0.298	0.342	

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Horse-Power Required

FOR COMPRESSING ONE CUBIC FOOT OF FREE AIR PER MINUTE (ISOTHERMALLY AND ADIABATICALLY) FROM SEA LEVEL ATMOSPHERIC PRESSURE (14.7 POUNDS) TO VARIOUS GAUGE PRESSURES

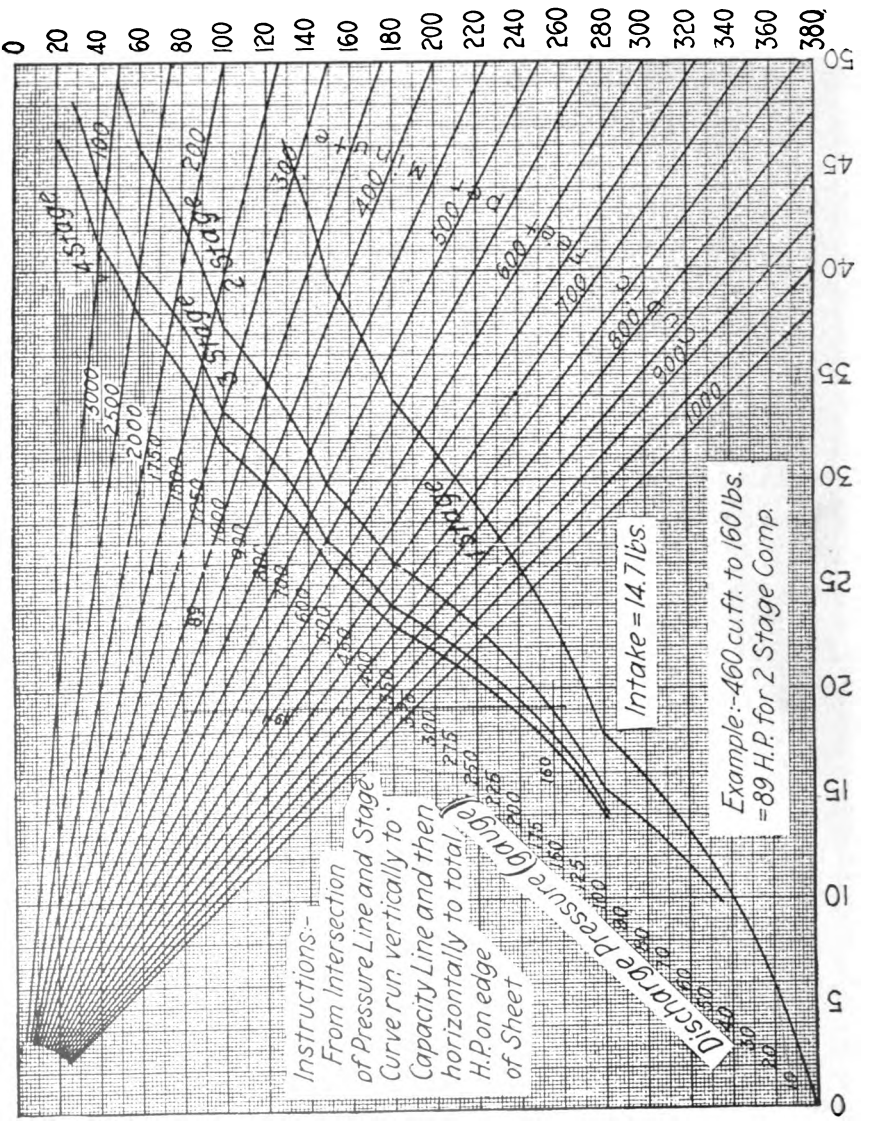
Three-Stage Compression
Intercooling back to initial temperature but jacket cooling not considered.

Gauge Pressure Pounds	Absolute Pressure Pounds	No. of Atmospheres	Correct Ratio of Cylinder Volumes	Intercooler Gauge Pressures		Isothermal Compression		Adiabatic Compression				Percentage Saving over Two-Stage Comp.
				First Stage	Second Stage	Mean Eff. Pressure	H. P.	Mean Eff. Pressure Theoretical	Mean Effective Pressure plus 15% Friction	H. P. Theoretical	H. P. plus15% Friction	
100	114.7	7.8	1.98	14.4	42.9	30.30	0.132	33.30	38.30	0.145	0.167	5.23
150	164.7	11.2	2.24	18.2	59.0	35.59	0.155	40.30	46.50	0.175	0.202	5.92
200	214.7	14.6	2.44	21.2	73.0	39.50	0.172	45.20	52.00	0.196	0.226	6.67
250	264.7	18.0	2.62	23.8	86.1	42.70	0.186	49.20	56.60	0.214	0.246	6.96
300	314.7	21.4	2.78	26.1	98.7	45.30	0.197	52.70	60.70	0.229	0.264	7.28
350	364.7	24.8	2.92	28.2	110.5	47.30	0.206	55.45	63.80	0.242	0.277	7.64
400	414.7	28.2	3.04	30.0	121.0	49.20	0.214	58.25	66.90	0.253	0.292	8.33
450	464.7	31.6	3.16	31.8	132.3	51.20	0.223	60.40	69.40	0.263	0.302	8.36
500	514.7	35.0	3.27	33.4	142.4	52.70	0.229	62.30	71.70	0.273	0.314	8.38
550	564.7	38.4	3.38	35.0	153.1	53.75	0.234	65.00	74.75	0.283	0.326	8.80
600	614.7	41.8	3.47	36.3	162.3	54.85	0.239	66.85	76.90	0.291	0.334	8.86
650	664.7	45.2	3.56	37.6	171.5	56.00	0.244	67.90	78.15	0.296	0.340	9.02
700	714.7	48.6	3.65	38.9	180.8	57.15	0.249	69.40	79.85	0.303	0.348	9.18
750	764.7	52.0	3.73	40.1	189.8	58.10	0.253	70.75	81.40	0.309	0.355	
800	814.7	55.4	3.82	41.4	199.5	59.00	0.257	72.45	83.25	0.315	0.362	
850	864.7	58.8	3.89	42.5	207.8	60.20	0.262	73.75	84.90	0.321	0.369	
900	914.7	62.2	3.95	43.4	214.6	60.80	0.265	74.80	86.00	0.326	0.375	
950	964.7	65.6	4.03	44.6	224.5	61.72	0.269	76.10	87.50	0.331	0.381	
1000	1014.7	69.0	4.11	45.7	233.3	62.40	0.272	77.20	88.80	0.336	0.383	
1050	1064.7	72.4	4.15	46.3	238.3	63.10	0.275	78.10	90.10	0.340	0.391	
1100	1114.7	75.8	4.23	47.5	248.3	63.80	0.278	79.10	91.10	0.344	0.396	
1150	1164.7	79.2	4.30	48.5	256.8	64.40	0.281	80.15	92.20	0.349	0.401	
1200	1214.7	82.6	4.33	49.0	261.3	65.00	0.283	81.00	93.15	0.353	0.405	
1250	1264.7	86.0	4.42	50.3	272.3	65.60	0.286	82.00	94.30	0.357	0.411	
1300	1314.7	89.4	4.48	51.3	280.8	66.30	0.289	82.90	95.30	0.362	0.416	
1350	1364.7	92.8	4.53	52.0	287.3	66.70	0.291	84.00	96.60	0.366	0.421	
1400	1414.7	96.2	4.58	52.6	293.5	67.00	0.292	84.60	97.30	0.368	0.423	
1450	1464.7	99.6	4.64	53.5	301.5	67.70	0.295	85.30	98.20	0.371	0.426	
1500	1514.7	103.0	4.69	54.3	309.3	68.30	0.298	85.80	98.80	0.374	0.430	
1550	1564.7	106.4	4.74	55.0	317.3	68.80	0.300	86.80	99.85	0.378	0.434	
1600	1614.7	109.8	4.79	55.8	323.3	69.10	0.302	87.60	100.80	0.382	0.438	

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THEORETICAL HORSE POWER CHART

ADIABATIC COMPRESSION—PERFECT INTERCOOLING
MECHANICAL FRICTION AND COMPRESSION LOSSES
NOT TAKEN INTO CONSIDERATION



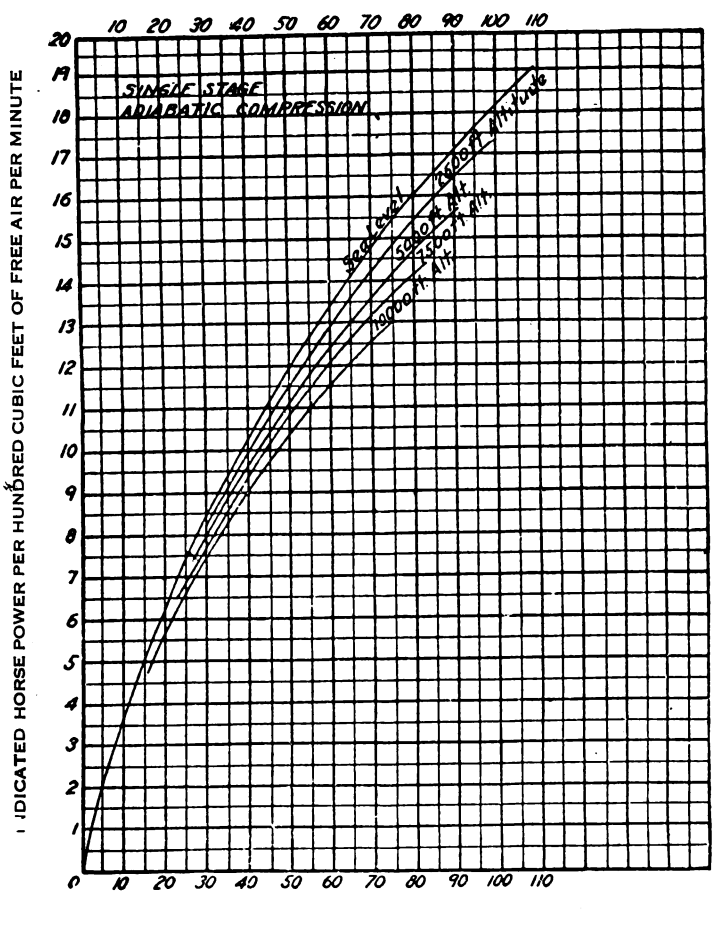
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THEORETICAL HORSE POWER

REQUIRED FOR COMPRESSION OF AIR AT DIFFERENT ALTITUDES

MECHANICAL FRICTION AND COMPRESSION LOSSES NOT TAKEN INTO CONSIDERATION

Single stage adiabatic compression

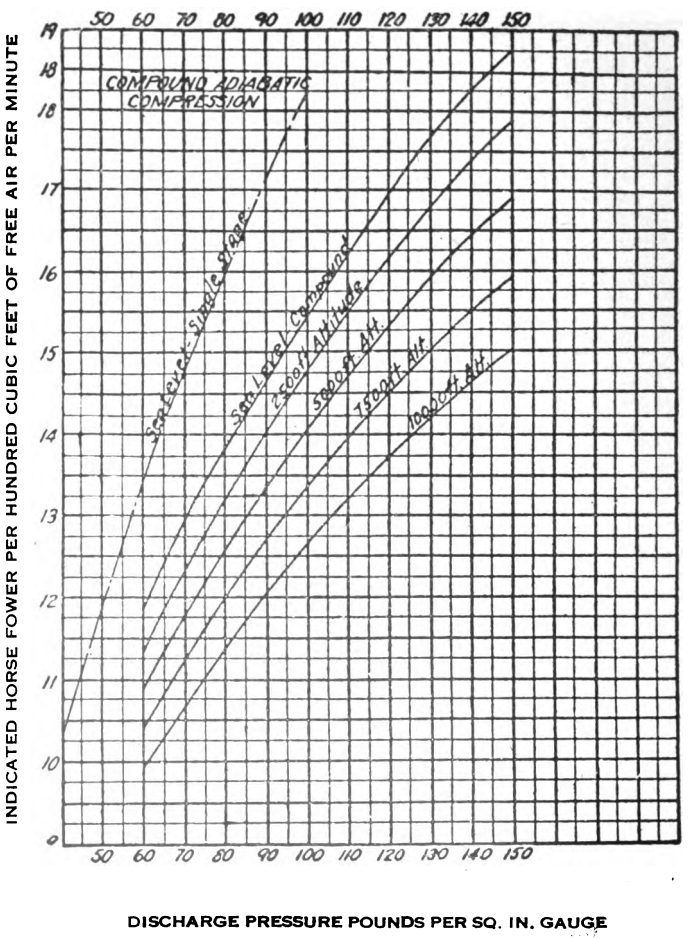


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THEORETICAL HORSE POWER REQUIRED FOR COMPRESSION OF AIR AT DIFFERENT ALTITUDES

MECHANICAL FRICTION AND COMPRESSION LOSSES NOT TAKEN INTO CONSIDERATION

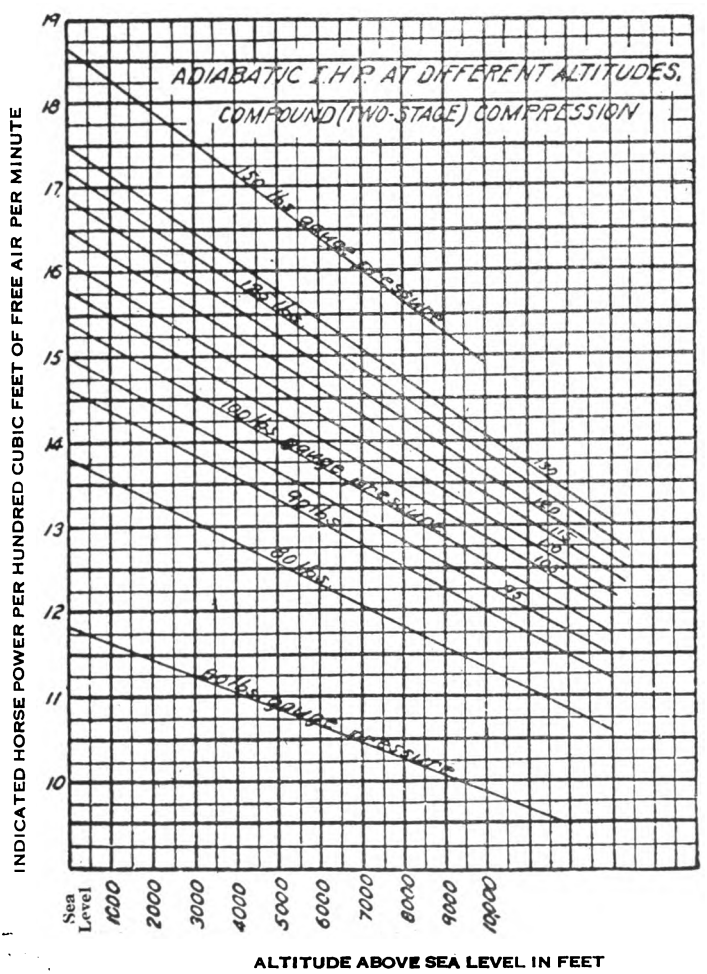
Two stage adiabatic compression



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THEORETICAL HORSE POWER REQUIRED FOR COMPRESSION OF AIR AT DIFFERENT ALTITUDES MECHANICAL FRICTION AND COMPRESSION LOSSES NOT TAKEN INTO CONSIDERATION

Two stage adiabatic compression



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Compressed Air Transmission

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Delivery in Cu. Ft. of Compressed Air per Min.	Equiv. Delivery in Cu. Ft. of Free Air per Min.	Size of Pipe, Inches: 1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12	14	1
		Loss of Pressure, in Pounds, by Friction in 1000 Feet Lengths of Pipe																	
At 60 Pounds Gauge																			
9.84	50	18.24	5.06	1.95	.42	.13	.05												
14.73	75		11.34	4.33	.95	.29	.11	.05											
19.64	100		20.16	7.79	1.69	.52	.19	.08	.04										
24.60	125			12.23	2.65	.81	.30	.13	.07	.03									
29.45	150			17.53	3.80	1.16	.44	.19	.09	.05	.03								
34.44	175				5.17	1.58	.59	.26	.13	.07	.04	.01							
39.35	200				6.77	2.09	.78	.36	.17	.09	.06	.02	.01						
49.20	250				10.61	3.24	1.22	.55	.27	.15	.08	.03	.01						
58.90	300				15.20	4.65	1.78	.78	.38	.21	.12	.05	.02	.01					
68.6	350					6.31	2.37	1.07	.53	.29	.17	.06	.03	.01					
78.6	400					8.28	3.11	1.40	.69	.39	.22	.08	.04	.01					
88.4	450					10.47	3.94	1.77	.88	.48	.28	.11	.05	.02	.01				
98.4	500						4.88	2.20	1.08	.60	.34	.14	.06	.03	.01				
118.1	600						7.03	3.17	1.56	.87	.49	.19	.09	.04	.02	.01			
137.5	700						9.52	4.29	2.12	1.17	.67	.27	.12	.06	.03	.02			
156.6	800							5.57	2.75	1.52	.87	.34	.15	.08	.04	.03	.01		
176.5	900							7.08	3.49	1.94	1.17	.43	.19	.09	.05	.03	.01		
196.4	1000							8.77	4.33	2.40	1.37	.54	.24	.12	.06	.04	.02	.01	
294.5	1500								9.73	5.39	3.08	1.20	.55	.27	.15	.09	.03	.01	
393.7	2000									9.65	5.51	2.16	.98	.41	.27	.16	.06	.03	.01
492	2500										8.61	3.36	1.53	.77	.42	.25	.09	.04	.02
589	3000											4.82	2.19	1.11	.61	.36	.14	.06	.03
686	3500											6.54	2.97	1.50	.83	.48	.19	.09	.04
786	4000												3.91	1.98	1.08	.63	.25	.11	.05
884	4500												4.94	2.51	1.36	.79	.32	.15	.07
984	5000												6.19	3.10	1.69	.99	.39	.18	.09
At 80 Pounds Gauge																			
7.74	50	14.31	3.96	1.53	.33	.10	.03	.01											
11.3	75		8.46	3.26	.71	.21	.08	.03	.01										
15.2	100		15.31	5.92	1.28	.39	.14	.06	.03	.02	.01								
19.4	125			9.64	2.09	.64	.24	.11	.05	.03	.01								
23.2	150			13.79	2.99	.91	.34	.15	.07	.04	.02	.01							
27.2	175				4.09	1.25	.47	.21	.10	.06	.03	.01							
31.0	200				5.34	1.63	.61	.27	.13	.07	.04	.01							
38.7	250				8.32	2.54	.96	.43	.21	.12	.07	.02	.01						
46.5	300				12.01	3.67	1.38	.62	.30	.17	.09	.03	.01						
54.2	350					4.99	1.88	.84	.41	.23	.13	.05	.02	.01					
62.0	400					6.53	2.45	1.11	.54	.30	.17	.06	.03	.01					
69.7	450					8.25	3.13	1.40	.69	.38	.22	.08	.04	.01					
77.4	500					10.81	3.83	1.73	.85	.47	.27	.10	.05	.02	.01				
92.9	600						5.61	2.46	1.22	.68	.39	.15	.06	.03	.02	.01			
108.2	700						7.46	3.37	1.66	.92	.53	.20	.09	.04	.02	.01			
124.0	800						9.86	4.42	2.18	1.19	.69	.27	.12	.06	.03	.02	.01		
139.5	900							5.61	2.77	1.54	.88	.34	.15	.08	.04	.02	.01		
152	1000							6.64	3.29	1.82	1.04	.40	.18	.09	.05	.03	.01		
232	1500							15.41	7.62	4.24	2.43	.95	.43	.22	.12	.06	.02	.01	
310	2000								13.62	7.58	4.32	1.69	.77	.39	.21	.12	.04	.02	.01
387	2500									11.79	6.88	2.64	1.19	.60	.33	.19	.07	.03	.01
465	3000										9.72	3.79	1.73	.87	.48	.28	.11	.05	.02
542	3500										13.25	5.27	2.35	1.19	.65	.37	.15	.06	.03
620	4000											6.78	3.07	1.55	.85	.49	.19	.09	.04
697	4500											8.54	3.89	1.97	1.08	.66	.25	.11	.05
774	5000											10.55	4.79	2.46	1.33	.77	.30	.14	.07

For longer or shorter pipes the friction loss is proportional to the length, i. e., for 500 feet ½ of the above; for 4,000 feet four times the above, etc. For pressure loss through fittings see table on page 10.

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Compressed Air Transmission

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Delivery in Cu. Ft. of Compressed Air per Min.	Equiv. Delivery in Cu. Ft. of Free Air per Min.	Size of Pipe, Inches: 1	1¼	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12	14	16
		Loss of Pressure, in Pounds, by Friction in 1000 Feet Lengths of Pipe																	
At 100 Pounds Gauge																			
6.41	50	11.89	3.29	1.28	.27	.08	.03	.01											
9.61	75		7.42	2.87	.62	.19	.07	.03	.01										
12.81	100		13.20	5.11	1.15	.34	.12	.05	.02	.01									
15.81	125			7.75	1.68	.52	.19	.08	.04	.02	.01								
19.22	150			11.42	2.48	.76	.29	.13	.06	.03	.02	.01							
22.39	175				3.36	1.03	.39	.17	.09	.04	.03	.01							
25.62	200				4.43	1.36	.51	.23	.12	.06	.04	.02	.01						
31.62	250				6.72	2.06	.77	.35	.17	.09	.05	.02	.01						
38.44	300				9.95	3.04	1.14	.51	.25	.14	.08	.03	.01						
44.78	350				13.41	4.11	1.54	.69	.34	.19	.11	.04	.02	.01					
51.24	400					5.40	2.06	.92	.45	.25	.15	.05	.03	.01					
57.65	450					6.85	2.57	1.16	.57	.32	.18	.07	.03	.02	.01				
63.24	500					8.21	3.08	1.39	.68	.38	.22	.08	.04	.02	.01				
76.88	600					12.21	4.58	2.14	1.03	.57	.33	.12	.05	.03	.02	.01			
89.56	700						6.19	2.79	1.38	.77	.44	.17	.07	.04	.02	.01			
102.5	800						8.13	3.67	1.81	1.00	.57	.22	.10	.05	.03	.02	.01		
115.3	900						10.23	4.64	2.29	1.27	.76	.28	.13	.06	.04	.02	.01		
126.5	1000						12.39	5.00	2.76	1.23	.88	.34	.16	.08	.04	.03	.01		
192.2	1500							12.81	6.68	3.51	2.03	.78	.36	.18	.09	.05	.02	.01	
256.2	2000								11.35	6.61	3.62	1.41	.67	.33	.18	.10	.04	.02	.01
316.2	2500									9.50	5.51	2.14	.97	.49	.27	.16	.06	.03	.01
384.4	3000									14.04	8.11	3.16	1.44	.76	.39	.23	.19	.04	.02
447.8	3500										10.95	4.26	1.93	.98	.53	.31	.12	.05	.03
512.4	4000										14.48	5.59	2.55	1.30	.72	.41	.16	.07	.04
576.5	4500											7.04	3.22	1.84	.89	.52	.21	.09	.05
632.4	5000											8.51	3.88	1.93	1.07	.63	.25	.11	.08
At 125 Pounds Gauge																			
5.26	50	9.88	2.70	1.05	.23	.07	.03	.01											
7.89	75	22.20	6.07	2.37	.51	.16	.06	.03	.01										
10.51	100	39.50	10.82	4.22	.91	.28	.10	.05	.02	.01									
13.15	125		16.88	6.58	1.42	.43	.16	.07	.04	.02	.01								
15.79	150		24.33	9.47	2.04	.63	.23	.11	.05	.03	.02	.01							
18.41	175		33.05	12.90	2.78	.85	.32	.14	.07	.04	.02	.01							
21.05	200			16.84	3.63	1.11	.42	.19	.09	.05	.03	.01							
26.30	250			26.30	5.68	1.73	.65	.29	.15	.08	.05	.02	.01						
31.58	300			37.90	8.18	2.51	.94	.42	.21	.12	.07	.03	.01						
36.81	350				11.08	3.39	1.27	.58	.28	.16	.09	.04	.02	.01					
42.10	400				14.51	4.44	1.67	.75	.37	.21	.12	.05	.02	.01					
47.30	450				18.38	5.61	2.11	.95	.47	.26	.15	.06	.03	.01	.01				
52.60	500				22.68	6.95	2.61	1.18	.58	.32	.18	.07	.03	.02	.01				
63.20	600					10.00	3.76	1.69	.84	.46	.27	.10	.05	.02	.01	.01			
73.70	700					13.60	5.11	2.31	1.14	.63	.36	.14	.06	.03	.02	.01			
84.20	800					17.80	6.68	3.01	1.49	.83	.47	.18	.08	.04	.02	.01	.01		
94.70	900						8.45	3.81	1.88	1.04	.60	.23	.11	.05	.03	.02	.01		
105.1	1000						10.42	4.71	2.32	1.29	.74	.29	.13	.07	.04	.02	.01		
157.9	1500						23.48	10.59	5.23	2.90	1.65	.64	.29	.15	.08	.05	.02	.01	
210.5	2000							18.81	9.30	5.15	2.94	1.15	.52	.26	.15	.08	.03	.02	.01
263.0	2500							29.40	14.52	8.05	4.60	1.80	.82	.41	.23	.13	.05	.02	.01
315.8	3000								20.90	11.59	6.63	2.59	1.18	.60	.33	.19	.07	.03	.02
368.1	3500								28.51	15.78	9.01	3.53	1.61	.81	.45	.26	.10	.04	.02
422.0	4000									20.61	11.80	4.61	2.19	1.06	.58	.34	.13	.06	.03
473.0	4500									26.10	14.90	5.83	2.65	1.34	.73	.43	.17	.08	.04
526.0	5000									32.20	18.45	7.20	3.27	1.65	.90	.53	.21	.10	.05

For longer or shorter pipes the friction loss is proportional to the length, i. e., for 500 feet ½ of the above; for 4,000 feet four times the above, etc. For pressure loss through fittings see table on page 10.

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Globe Valves, Tees and Elbows

The reduction of pressure produced by globe valves is the same as that caused by the following additional lengths of straight pipe, as calculated by the formula:

$$\text{Additional length of pipe} = \frac{114 \times \text{diameter of pipe}}{1 + (3.6 \div \text{diameter})}$$

Diameter of pipe	1	1½	2	2½	3	3½	4	5	6	inches
Additional length	2	4	7	10	13	16	20	28	36	feet
	7	8	10	12	15	18	20	22	24	inches
	44	53	70	88	115	143	162	181	200	feet

The reduction of pressure produced by elbows and tees is equal to two-thirds of that caused by globe valves. The following are the additional lengths of straight pipe to be taken into account for elbows and tees. For globe valves multiply by ⅔:

Diameter of pipe	1	1½	2	2½	3	3½	4	5	6	inches
Additional length	2	3	5	7	9	11	13	19	24	feet
	7	8	10	12	15	18	20	22	24	inches
	30	35	47	59	77	96	108	120	134	feet

These additional lengths of pipe for globe valves, elbows and tees must be added in each case to the actual length of straight pipe. Thus a 6-inch pipe, 500 feet long, with 1 globe valve, 2 elbows and 3 tees, would be equivalent to a straight pipe $500 + 36 + (2 \times 24) + (3 \times 24) = 656$ feet long.

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Displacement In Cubic Feet Per Minute

PISTON WORKING IN SINGLE CYLINDER AT VARIOUS PISTON SPEEDS

Double Acting Piston Rods Not Considered

Diam. of Cylinder Inches	Piston Speed, Feet per Minute																	
	100	150	200	225	250	275	300	325	350	375	400	425	450	475	500	550	600	700
	Displacement in Cubic Feet per Minute																	
3	4.9	7.4	9.8	11.1	12.3	13.5	14.7	16	17.2	18.5	19.6	21	22.2	23.4	24.6	27	29.4	34.4
4	8.7	13.1	17.4	19.7	21.8	24	26.2	28.5	30.7	32.9	34.8	37.2	39.4	41.5	43.6	48	52.4	61.4
5	13.6	20.5	27.2	30.8	34.2	37.5	41	44.5	48	51.4	54.4	58	61.6	65	68.4	75	82	96
6	19.6	29.5	39.2	44.4	49	54	59	64	69	74	78.4	84	88.8	93	98	108	118	138
7	26.7	40	53.4	60.5	67	74	80	87	94	100.6	106.8	114	121	127	134	148	130	188
8	35	52.5	70	79	87.5	96	105	114	123	132	140	149	158	166	175	192	210	246
9	44	66.5	88	100	110	122	133	144	155	166	176	188	200	210	220	244	266	310
10	54.5	82	109	123	136	150	164	178	192	206	218	233	246	260	272	300	328	384
11	66	99	132	149	165	182	198	215	232	250	264	282	298	315	330	364	336	464
12	78	118	156	177	196	216	236	256	276	296	312	335	354	374	392	432	472	552
13	92	138	184	208	230	255	276	300	325	345	368	392	416	440	460	510	552	650
14	106	160	212	240	266	295	320	348	375	400	424	455	480	510	532	590	640	750
15	122	184	244	276	305	337	368	400	432	460	488	521	552	580	610	674	736	864
16	139	210	278	315	350	385	420	455	490	525	556	595	630	660	700	840	840	980
17	157	236	314	355	395	435	472	512	550	509	628	672	710	750	790	870	944	1100
18	176	265	352	400	440	485	530	575	620	660	704	755	800	840	880	970	1060	1240
19	196	295	392	445	490	540	590	640	690	740	784	840	890	930	980	1080	1130	1380
20	218	328	436	490	545	600	656	710	765	820	872	930	980	1040	1090	1200	1312	1530
22	265	395	530	595	660	725	790	790	930	990	1060	1120	1190	1260	1320	1450	1580	1860
24	314	470	628	710	790	865	940	1020	1100	1180	1256	1340	1420	1500	1580	1730	1880	2200
26	369	550	738	830	920	1020	1100	1200	1300	1390	1476	1570	1660	1750	1840	2040	2200	2600
28	427	640	854	900	1070	1180	1280	1390	1500	1600	1780	1820	1920	2030	2140	2360	2560	3000
30	490	740	980	1110	1230	1350	1480	1600	1720	1840	1960	2100	2220	2340	2460	2700	2960	3440
32	560	835	1120	1260	1400	1540	1670	1820	1960	2100	2240	2380	2520	2660	2800	3080	3340	3920
34	630	945	1260	1420	1570	1740	1890	2050	2220	2360	2520	2690	2840	3000	3140	3480	3780	4440
36	710	1060	1420	1600	1770	1950	2120	2300	2500	2650	2840	3000	3200	3360	3540	3900	4240	5000
38	780	1180	1560	1780	1960	2170	2360	2560	2750	2950	3120	3350	3560	3750	3920	4340	4720	5500
40	870	1310	1740	1970	2180	2400	2620	2850	3060	3280	3480	3720	3940	4150	4360	4800	5240	6120

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Discharge of Air Through An Orifice

IN CUBIC FEET OF FREE AIR PER MINUTE

Flowing From a Round Hole Having Rounded Inner Edges, Into the Atmosphere
For a round hole having sharp inner edges the quantity will be approximately 70% of tabulated figures.

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Receiver Gauge Pressure Pounds	Diameter of Orifice													
	1/64 inch	1/32 inch	1/16 inch	1/8 inch	1/4 inch	3/8 inch	1/2 inch	5/8 inch	3/4 inch	7/8 inch	1 inch	1 1/4 inch	1 1/2 inch	2 inch
	Discharge in Cubic Feet of Free Air per Minute													
2	.038	.153	.647	2.435	9.74	21.95	39.	61	87.60	119.50	156.	242.	350	625.
5	.0597	.242	.965	3.86	15.40	34.60	61.60	96.50	133.	189.	247.	384.	550.	985.
10	.0842	.342	1.36	5.45	21.8	49.	87.	136.	196.	267.	350.	543.	780.	
15	.103	.418	1.67	6.65	26.70	60.	107.	167.	240.	326.	427.	665.	960.	
20	.119	.485	1.93	7.7	30.8	69.	123.	193.	277.	378.	494.	770.		
25	.133	.54	2.16	8.6	34.5	77.	138.	216.	310.	422.	550.	860.		
30	.156	.632	2.52	10.	40.	90.	161.	252.	362.	493	645	1000.		
35	.173	.71	2.80	11.2	44.7	100.	179.	280.	400.	550.	715.			
40	.19	.77	3.07	12.27	49.09	110.45	196.35	306.80	441.79	601.32	785.40			
45	.208	.843	3.36	13.4	53.8	121.	215.	336.	482.	658.	860.			
50	.225	.914	3.64	14.50	58.2	130.	232.	364.	522.	710.	930.			
60	.26	1.05	4.2	16.8	67.	151.	268.	420.	604.	622.				
70	.295	1.19	4.76	19.	76.	171.	304.	476.	685.	930.				
80	.33	1.33	5.32	21.2	85.	191.	340.	532.	765.	1004.				
90	.364	1.47	5.87	23.50	94.	211.	376.	587.	843.					
100	.40	1.61	6.45	25.8	103.	231.	412.	645.	925.					
125	.486	1.97	7.85	31.4	125.	282.	502.	785.						

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Weight of Air At Various Pressures and Temperatures

Based on an Atmospheric Pressure of 14.7 Pounds Absolute at Sea Level

Temp. of Air Deg. Fahr.	Gauge Pressure. Pounds																					
	0	5	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	175	200	225	250	300
	Weight in Pounds per Cubic Foot																					
—20	.0900	.1205	.1515	.2125	.2744	.3360	.3970	.4580	.5190	.5800	.6410	.702	.7635	.825	.886	.948	1.010	1.165	1.318	1.485	1.625	1.930
—10	.0882	.1184	.1485	.2090	.2685	.3283	.3880	.4478	.5076	.5674	.6272	.687	.747	.807	.868	.928	.989	1.139	1.288	1.438	1.588	1.890
0	.0864	.1160	.1455	.2040	.2630	.3215	.3800	.4385	.4970	.5555	.6140	.672	.731	.790	.849	.908	.968	1.114	1.260	1.406	1.553	1.850
10	.0846	.1136	.1425	.1995	.2568	.3145	.3720	.4292	.4863	.5433	.6006	.658	.716	.774	.832	.889	.947	1.090	1.233	1.376	1.520	1.810
20	.0828	.1112	.1395	.1955	.2516	.3071	.3645	.4205	.4770	.5330	.5890	.645	.701	.757	.813	.869	.927	1.067	1.208	1.348	1.489	1.770
30	.0811	.1088	.1366	.1916	.2465	.3015	.3570	.4121	.4672	.5221	.5771	.632	.687	.742	.797	.852	.908	1.046	1.184	1.322	1.460	1.735
40	.0795	.1067	.1338	.1876	.2415	.2954	.3503	.4038	.4576	.5114	.5652	.619	.673	.727	.781	.835	.890	1.025	1.161	1.296	1.431	1.701
50	.0780	.1045	.1310	.1839	.2367	.2905	.3432	.3960	.4487	.5014	.5541	.607	.660	.713	.766	.819	.873	1.006	1.139	1.271	1.403	1.668
60	.0764	.1025	.1283	.1803	.2323	.2840	.3562	.3882	.4402	.4927	.5447	.596	.649	.700	.752	.804	.856	.988	1.116	1.245	1.376	1.636
70	.0750	.1005	.1260	.1770	.2280	.2791	.3302	.3808	.4316	.4824	.5332	.584	.635	.686	.737	.788	.839	.967	1.095	1.223	1.350	1.604
80	.0736	.0988	.1239	.1738	.2237	.2739	.3242	.3738	.4234	.4729	.5224	.572	.622	.673	.723	.774	.824	.949	1.074	1.199	1.325	1.573
90	.0723	.0970	.1218	.1707	.2195	.2688	.3182	.3670	.4154	.4639	.5122	.561	.611	.660	.709	.759	.809	.932	1.054	1.177	1.300	1.544
100	.0710	.0954	.1197	.1676	.2155	.2638	.3122	.3602	.4079	.4555	.5033	.551	.599	.648	.696	.745	.794	.914	1.035	1.155	1.276	1.517
110	.0698	.0937	.1176	.1645	.2115	.2593	.3070	.3542	.4011	.4481	.4950	.542	.589	.637	.685	.732	.780	.899	1.017	1.135	1.254	1.491
120	.0686	.0921	.1155	.1618	.2080	.2549	.3018	.3481	.3944	.4403	.4866	.533	.579	.626	.673	.720	.767	.884	1.001	1.118	1.234	1.465
130	.0674	.0905	.1135	.1590	.2045	.2505	.2966	.3446	.3924	.4296	.4770	.524	.570	.616	.662	.708	.754	.869	.984	1.099	1.214	1.440
140	.0663	.0889	.1115	.1565	.2015	.2465	.2915	.3364	.3813	.4262	.4711	.516	.561	.606	.651	.696	.742	.855	.963	1.081	1.194	1.416
150	.0652	.0874	.1096	.1541	.1985	2425	2865	.3308	.3751	.4193	.4636	.508	.552	.596	.640	.685	.730	.841	.953	1.064	1.175	1.392
175	.0626	.0840	.1054	.1482	.1910	2335	.2755	.3181	.3607	.4033	.4450	.488	.531	.573	.616	.658	.701	.893	.914	1.021	1.128	1.337
200	.0603	.0809	.1014	.1427	.1840	.2248	.2655	.3054	.3473	.3882	.4291	.470	.511	.552	.592	.633	.674	.776	.879	.982	1.084	1.287
225	.0581	.0779	.0976	.1373	.1770	.2163	.2555	.2949	.3344	.3738	.4129	.452	.491	.531	.570	.609	.649	.747	.846	.944	1.043	1.240
250	.0560	.0751	.0941	.1323	.1705	.2085	.2466	.2845	.3223	.3602	.3981	.436	.474	.513	.551	.589	.627	.722	.817	.912	1.007	1.197
275	.0541	.0726	.0910	.1278	.1645	.2011	.2378	.2745	.3111	.3478	.3844	.421	.458	.494	.531	.568	.605	.697	.789	.881	.972	1.155
300	.0523	.0707	.0881	.1237	.1592	.1945	.2300	.2654	.3008	.3362	.3716	.407	.442	.478	.513	.549	.585	.673	.762	.852	.940	1.118
350	.0491	.0658	.0825	.1160	.1495	.1828	.2160	.2492	.2824	.3156	.3488	.382	.415	.449	.482	.516	.549	.632	.715	.799	.883	1.048
400	.0463	.0621	.0779	.1090	.1405	.1720	.2035	.2348	.2661	.2974	.3287	.360	.391	.423	.454	.486	.517	.596	.674	.753	.831	.987
450	.0437	.0586	.0735	.1033	.1330	.1628	.1925	.2220	.2515	.2810	.3105	.340	.369	.399	.429	.458	.488	.562	.637	.711	.786	.934
500	.0414	.0555	.0696	.0978	.1260	1540	.1820	.2100	.2330	.2660	.2940	.322	.351	.379	.407	.435	.463	.534	.604	.675	.746	.885
550	.0394	.0528	.0661	.0930	.1198	.1464	.1730	.1996	.2262	.2528	.2794	.306	.333	.359	.386	.413	.440	.507	.573	.641	.709	.841
600	.0376	.0504	.0631	.0885	.1140	.1395	.1650	1904	.2158	.2412	.2668	.292	.317	.343	.368	.393	.419	483	547	.611	.675	.801

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Compressed Air Table

FOR HOISTING ENGINES

The following table is intended to give an approximate idea of the volume of free air required for operating hoisting engines, the air being delivered to the engines at 60 pounds gauge pressure. There are so many variable conditions in the operation of hoisting by the hoisting engines in common use that accurate computations can only be offered when fixed data are given. In the table, the hoisting engine is assumed to actually run but one-half of the time for hoisting, while the compressor, of course, runs continuously. If the engine runs less than one-half the time, as it usually does, the volume of air required will be proportionately less, and *vice versa*. The table is computed for maximum loads, which also in practice may vary widely. From the intermittent character of the work of a hoisting engine the parts are able to resume their normal temperature between the hoists, and there is little probability of the annoyance of freezing up the exhaust passages.

TABLE OF THE VOLUME OF FREE AIR REQUIRED FOR OPERATING HOISTING ENGINES

The Air Compressed to 60 Pounds Gauge Pressure

Diameter of Cylinder Inches	Stroke Inches	R. P. M.	Normal Horsepower	Actual Horsepower	Weight Lifted Single Rope	Cubic Feet of Free Air Required
Single Cylinder Hoisting Engine						
5	6	200	3	5.9	600	75
5	8	160	4	6.3	1000	80
6¼	8	160	6	9.9	1500	125
7	10	125	10	12.1	2000	151
8¼	10	125	15	16.8	3000	170
8½	12	110	20	18.9	5000	238
10	12	110	25	26.2	6000	330
Double Cylinder Hoisting Engine						
5	6	200	6	11.8	1000	150
5	8	160	8	12.6	1650	160
6¼	8	160	12	19.8	2500	250
7	10	125	20	24.2	3500	302
8¼	10	125	30	33.6	6000	340
8½	12	110	40	37.8	8000	476
10	12	110	50	52.4	10000	660
12¼	15	100	75	89.2		1125
14	18	90	100	125.		1587

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Air Required

TO HOIST ONE TON (2240 POUNDS) OF ROCK AT VARIOUS ANGLES OF SLOPE

Angles Measured from the Horizontal

(Original By F. A. Halsey.)

Angle of Slope Degrees	Cubic Feet of Free Air Consumed per Minute of Actual Hoisting (speed of rope being 350 feet per minute)	Cubic Feet of Free Air Consumed for Each 100 Feet of Hoist (measured on the slope)
0	11	3.14
5	90	25.7
10	100	45.6
15	230	65.7
20	320	91.2
25	400	114
30	470	134
35	520	148
40	590	168
45	650	186
50	700	200
60	790	225
75	880	250
90	900	257

This table includes the power required to hoist the skip and rope and overcome the friction. It assumes that 20 per cent of the power of the engine is consumed in its own friction and that of the gearing; that the skip weighs one-half as much as its contents; and that the traction on a horizontal mine track is 30 pounds per ton; and it provides for 500 feet of wire rope.

The consumption of air is based on the assumption that the engine is of the plain slide valve pattern, of good construction and in good condition, and that it is loaded to nearly or quite full capacity. It should be remembered that the table gives the consumption of air while the engine is actually in motion. In estimating the consumption per hour, allowance should be made for the time that the engine stands idle. If the compressor is a large one, doing other work—drilling, pumping, etc.—the compressor capacity should be based on the hourly consumption in which allowance is made for the time the hoist stands idle, but if the compressor is driving the hoist alone, it is advisable to consider the hoist as running continuously (whether it really is or not) and figure the compressor on that basis. For a balanced hoist use only the *unbalanced load* in applying this rule. If the engine is not loaded to its full capacity, the air being throttled, it will require more air to do the same work. Decreasing the speed of hoisting will diminish the power developed and the air consumed per minute but as the time of hoisting is thereby lengthened, the air consumed per hoist will remain unchanged. Increased speed will give a corresponding result.

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Compressed Air Table For Pumping Plants

For the convenience of engineers and others figuring on pumping plants to be operated by compressed air, we subjoin a table by which the pressure and volume of air required for any size pump can be readily ascertained. Reasonable allowances have been made for loss due to clearances in pump and friction in pipe.

Perpendicular Height in Feet to Which the Water is to be Pumped	Ratio of Diameters of Air and Water Cylinders											
	1 to 1		1½ to 1		1¾ to 1		2 to 1		2¼ to 1		2½ to 1	
	Air Pressure at Pump Lbs.	Cu Ft. Free Air per Gal. of Water	Air Pressure at Pump Lbs.	Cu. Ft. Free Air per Gal. of Water	Air Pressure at Pump Lbs.	Cu. Ft. Free Air per Gal. of Water	Air Pressure at Pump Lbs.	Cu. Ft. Free Air per Gal. of Water	Air Pressure at Pump Lbs.	Cu. Ft. Free Air per Gal. of Water	Air Pressure at Pump Lbs.	Cu. Ft. Free Air per Gal. of Water
25	13.75	0.21										
50	27.5	0.45	12.22	0.65								
75	41.25	0.60	18.33	0.80	13.75	0.94						
100	55.0	0.75	24.44	0.95	19.8	1.14	13.75	1.23				
125	68.25	0.89	30.33	1.09	22.8	1.24	17.19	1.37	13.75	1.533		
150	82.5	1.04	36.66	1.24	27.5	1.30	20.63	1.52	16.5	1.68	13 2	1.79
175	96.25	1.20	42.76	1.39	32.1	1.54	24.06	1.66	19.25	1.83	15.4	1.98
200	110.0	1.34	48.88	1.53	36.66	1.69	27.5	1.81	22.0	1.97	17.6	2.06
225			55.0	1.68	41.25	1.84	30.94	1.96	24.75	2.12	19.8	2.104
250			61.11	1.83	45.83	1.99	34.38	2.11	27.5	2.26	22.0	2.34
300			73.32	2.12	55.0	2.39	41.25	2.40	33.0	2 56	26.4	2.62
350			85.4	2.41	64.16	2.59	48.13	2.69	38.5	2.85	30.8	2.88
400			97.66	2.70	73.33	2.88	55.0	2.98	44.0	3.15	35.2	3.18
450					82.5	3.19	61 88	3.28	49.5	3.44	39.6	3.36
500							68.75	3.57	55.0	3.73	44.0	3.23

To find the amount of air and pressure required to pump a given quantity of water a given height, find the ratio of diameters between water and air cylinders, and multiply the number of gallons of water by the figure found in the column for the required lift. The result is the number of cubic feet of free air. The pressure required on the pump will be found in the column directly opposite. For example: The ratio between cylinders being 2 to 1, required to pump 100 gallons, height of lift 250 feet. We find opposite 250 at ratio 2 to 1, the figures 2.11; 2.11 × 100=211 cubic feet of free air. The pressure required is 34.38 pounds delivered at the pump piston.

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Drill Capacity Tables

The tables on the next page will determine the amount of free air required to operate rock drills at various altitudes with air at given pressures.

They are intended for fair conditions in ordinary hard rock, but owing to varying conditions it is impossible to make any guarantee without a full knowledge of existing conditions.

In soft material, where the actual time of drilling is short, more drills can be run with a given sized compressor than when working in hard material, when the drills would be working continuously for a longer period, thereby increasing the chance of more drills operating at the same time.

In tunnel work, where the rock is hard, it has been the experience that more rapid progress has been made when the drills were operated under a high air pressure, and it has been found profitable to provide compressor capacity in excess of the requirements by about 25 per cent. There is also a distinct advantage in having a compressor of larger capacity, in that it saves the trouble and expense of moving the compressor as the work progresses, and will not interfere with the work of driving the tunnel.

No allowance has been made in the tables for loss due to leaky pipes, or for transmission loss due to friction; but the capacities given are merely the displacement required, so that when selecting a compressor for the work required these matters must be taken into account.

Table "A" gives cubic feet of free air required to operate one reciprocating piston drill of a given size and under a given pressure.

In modern hammer drills the type of valve and piston, and the number of blows struck per minute varies so greatly, that it is impossible to prepare a general table on air consumption. However, experience has shown that TABLE—A may be used for hammer drills of corresponding piston diameters for general estimating purposes. For accurate calculation it is advisable to secure from the manufacturer, the air consumption tables pertaining to the particular drills used.

Table "B" gives multiplication factors for altitudes and number of drills, by which the air consumption of one drill must be multiplied in order to give the total amount of air.

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Table A—Cubic Feet of Free Air

REQUIRED TO RUN ONE RECIPROCATING PISTON DRILL OF SIZE AND AT THE PRESSURE STATED BELOW

Gauge Pressure Lbs.	Cylinder Diameter of Drill												
	2"	2¼"	2½"	2¾"	3"	3⅛"	3⅜"	3¼"	3½"	3⅝"	4¼"	5"	5½"
60	50	60	68	82	90	95	97	100	108	113	130	150	164
70	56	68	77	93	102	108	110	113	124	129	147	170	181
80	63	76	86	104	114	120	123	127	131	143	164	190	207
90	70	84	95	115	126	133	136	141	152	159	182	210	230
100	77	92	104	126	138	146	149	154	166	174	199	240	252

Table B—Multipliers

TO DETERMINE CAPACITY OF COMPRESSOR REQUIRED TO OPERATE FROM 1 TO 70 ROCK DRILLS AT ALTITUDES COMPARED WITH SEA LEVEL

Altitude Above Sea Level Feet	Number of Drills																		
	1	2	3	4	5	6	7	8	9	10	12	15	20	25	30	40	50	60	70
	Multipliers																		
0	1.	1.8	2.7	3.4	4.1	4.8	5.4	6.0	6.5	7.1	8.1	9.5	11.7	13.7	15.8	21.4	25.5	29.4	33.2
1000	1.03	1.85	2.78	3.5	4.22	4.94	5.56	6.18	6.69	7.3	8.34	9.78	12.05	14.1	16.3	22.0	26.26	30.3	34.2
2000	1.07	1.92	2.89	3.64	4.39	5.14	5.78	6.42	6.95	7.60	8.67	10.17	12.52	14.66	16.9	22.9	27.28	31.46	35.52
3000	1.10	1.98	2.97	3.74	4.51	5.28	5.94	6.6	7.15	7.81	8.91	10.45	12.87	15.07	17.38	23.54	28.05	32.34	36.52
4000	1.14	2.05	3.08	3.88	4.67	5.47	6.15	6.84	7.41	8.09	9.23	10.83	13.34	15.62	18.01	24.4	29.07	33.52	37.8
5000	1.17	2.10	3.16	3.98	4.8	5.62	6.32	7.02	7.61	8.31	9.48	11.12	13.69	16.03	18.49	25.04	29.84	34.4	38.84
6000	1.20	2.16	3.24	4.08	4.9	5.76	6.48	7.2	7.8	8.52	9.72	11.4	14.04	16.44	18.96	25.68	30.6	35.4	39.84
7000	1.23	2.21	3.32	4.18	5.04	5.9	6.64	7.38	7.99	8.73	9.96	11.68	14.39	16.85	19.43	26.32	31.36	36.16	40.84
8000	1.26	2.27	3.40	4.28	5.17	6.05	6.8	7.56	8.19	8.95	10.21	11.97	14.74	17.26	19.9	29.96	32.13	37.04	41.83
9000	1.29	2.32	3.48	4.39	5.29	6.19	6.96	7.74	8.38	9.16	10.45	12.26	15.09	17.67	20.38	27.6	32.9	37.92	42.83
10000	1.32	2.38	3.56	4.49	5.41	6.34	7.13	7.92	8.58	9.37	10.69	12.54	15.44	18.08	20.86	28.25	33.66	38.8	43.82
12000	1.37	2.47	3.70	4.66	5.62	6.57	7.4	8.22	8.9	9.73	11.1	13.02	16.03	18.77	21.64	29.32	34.94	40.28	45.48
15000	1.43	2.57	3.86	4.86	5.86	6.86	7.72	8.58	9.3	10.15	11.58	13.58	16.73	19.59	22.59	30.6	36.46	42.04	47.47

Example—Required the amount of free air necessary to operate thirty 5-inch drills at 9,000 feet altitude, using to operate these drills air at a gauge pressure of 80 pounds per square inch.

From Table **A** we find, when operating the drills at 80 pounds gauge pressure at sea level, that one 5-inch drill requires 190 cubic feet of free air per minute.

From Table **B** we also find that the factor for 30 drills at 9,000 feet altitude is 20.38; multiplying 190 cubic feet by 20.38 gives 3,872 cubic feet free air per minute, which is the displacement of a compressor for the above outfit under average conditions, to which must be added pipe line losses, such as friction and leakage.

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TRANSMISSION OF HORSE POWER BY LEATHER BELTING

The table below and the chart on Page 20 furnish an easy graphic solution of belt problems within the range of ordinary industrial conditions and is based on leather belts on iron pulleys. For paper pulleys add 30 per cent to the horsepower values on the chart. For 4-ply canvas or rubber belts use the curve for single leather belts.

Example: Given a 10″ pulley running at 1000 r.p.m. with a 160-deg. arc of contact and single leather belt; to find the width of the belt required to transmit 10 h.p. Starting at the pulley diameter of 10″ read horizontally to the intersection of the 1000 r.p.m. diagonal; then vertically to the intersection of the 180 deg. horizontal. By following down the diagonal to the 160-deg. line, correction is made for the reduced arc of contact. Then reading vertically to the intersection of the single belt curve and horizontally to the scale, a value of approximately 3 h.p. per in. width is obtained. To transmit 10 h.p. a belt 3 1-3″ wide would be required. A 4″ belt would probably be used since it is the next standard width.

SINGLE BELTS

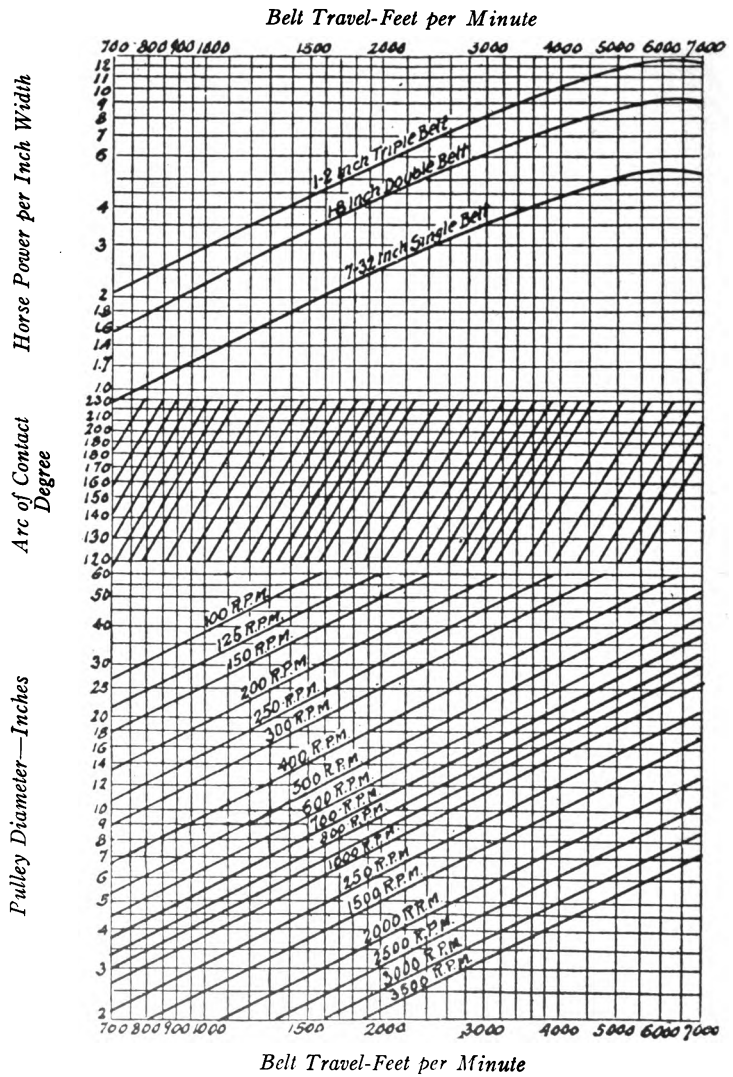
Speed in Ft. Per Min.	600	1200	1800	2400	3000	3600	4200	4800	5400	6000
Width of Belt	HORSE POWER									
2 in.	2	4	6	8	10	12	14	16	18	20
3 in.	3	6	9	12	15	18	21	24	27	30
4 in.	4	8	12	16	20	24	28	32	36	40
5 in.	5	10	15	20	25	30	35	40	45	50
6 in.	6	12	18	24	30	36	42	48	54	60
8 in.	8	16	24	32	40	48	56	64	72	80
9 in.	9	18	27	36	45	54	63	72	81	90
10 in.	10	20	30	40	50	60	70	80	90	100
12 in.	12	24	36	48	60	72	84	96	108	120
14 in.	14	28	42	56	70	84	98	112	126	140
16 in.	16	32	48	64	80	96	112	128	144	160

DOUBLE BELTS

Speed in Ft. Per Min.	400	800	1200	1600	2000	2400	2800	3200	3600	4000	5000
Width of Belt	HORSE POWER										
4 in.	4	8	13	17	21	25	30	34	38	42	53
6 in.	6	13	19	25	32	38	45	51	57	64	80
8 in.	8	17	25	34	42	51	60	68	77	85	106
10 in.	10	21	32	42	53	64	74	85	96	106	133
12 in.	13	25	38	51	64	76	89	102	115	128	160
16 in.	17	34	51	68	85	102	119	136	153	170	213
20 in.	21	42	64	85	106	128	149	170	192	213	266
24 in.	25	51	76	102	128	153	179	205	230	256	320
30 in.	32	64	96	128	160	192	224	256	288	320	400
36 in.	38	76	115	153	192	230	269	307	345	384	480
40 in.	42	85	128	170	213	256	298	341	384	426	533

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Transmission of Horse-Power by Leather Belting



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Uses of Compressed Air

The following list is not supposed to cover all possible applications of compressed air, but represents some of the applications which have been met in the Company's experience and for which machines have been applied.

ACID WORKS
Agitating, Elevating and Transferring Acids and Acid Solutions
Pumping Water

ASPHALT REFINERIES
Agitating Asphalt
Scaling Asphalt Tanks or Vats

AGRICULTURAL IMPLEMENT MAKERS
Operating Pneumatic Hammers and Drills
Running Pneumatic Hoists and Lifts
Sand Blast for Cleaning Castings and Removing Paint
Pneumatic Painting and Whitewashing
Blowing Oil Furnaces
Cleaning Boiler Tubes

AUTOMOBILE GARAGES AND REPAIR SHOPS
Pumping Up Tires
Cleaning Engines and Machines by the Air Jet
Operating Jacks, Lifts and Hoists
Running Pneumatic Hammers, Drills, Reamers, etc.
Cleaning Cars and Cushions with the Air Jet
Operating Brazing Forges
Supplying Oil Burners
Starting Gas and Gasoline Engines

BLEACHERIES
Pumping Water
Handling Chlorine or Bleaching Solutions
Agitating Liquids

BOILER SHOPS
Running Chipping, Riveting and Calking Hammers
Operating Drills, Reamers, Flue Rollers, Flue Expanders, Stay Bolt Cutters, Punches, etc.
Blowing Rivet Forges
Supplying Hoists, Lifts and Jacks
Cleaning Boiler Flues
Removing Scale, Rust and Paint by the Sand Blast

BREWERIES
Pumping Water
Racking Beer
Scaling Condenser Coils
Cleaning Boiler Tubes
Cleaning Machines by the Air Jet
Operating Air Hoists and Lifts
Refrigeration

BRIDGE BUILDERS
Operating Chipping and Riveting Hammers, Drills, Reamers, Punches, etc.
Supplying Air Hoists and Lifts
Blowing Rivet Forges
Cleaning Steel with the Sand Blast
Pneumatic Paint Spraying System
Operating Bolt Heading Machines

CEMENT BLOCK FACTORIES
Operating Sand Sifters
Running Concrete Rammers
Air Hoists and Lifts

CEMENT LAKES
Pumping Marl or Slurry by the Return-Air System

CEMENT MINES OR QUARRIES
Operating Rock Drills

CHEMICAL WORKS
Pumping Water
Agitating, Aerating, Elevating and Transferring Liquids
Testing and Calking Tanks and Pipe Lines

CHINA WORKS AND POTTERIES
Spraying Colors and Enamels

COAL MINES
Operating Coal Punchers, Chain Machines and Radialaxe Coal Cutters
Running Rock Drills and Hammer Drills
Pneumatic Haulage Systems

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Return-Air System for Station and Sump Pumping
Operating Direct-Acting Pumps
Running Coal Pick and Drill Sharpeners
Cleaning Boiler Flues
Pneumatic Tools for the Repair Shop
Air Hoists, Lifts and Motors
Pile Drivers for Shaft Sinking
Air Lift Pump for Water Supply or Mine Unwatering

CONTRACT WORK
Running Rock Drills, Hammer Drills and Stone Channelers
Operating Pneumatic Hammers, Drills and Reamers
Calking Pipe Lines and Tanks
Tamping Earth Around Pipe in Back Fill
Running Pumps
Plug Drills in Trenching
Sheet Pile Drivers
Drill Sharpeners
Blowing Smith Fires
Submarine Drills
Subaqueous Tunneling
Caisson Work
Steam Shovels

COTTON FINISHING WORKS
Pumping Water
Operating Baling Presses
Cleaning Presses, Slashers, and other Machines by the Air Jet
Agitating, Elevating and Transferring Dyes and Solutions
Air Hoists, Lifts and Motors
Automatic Sprinkler Systems
Humidifying Systems

COTTON MILLS
Pumping Water
Cleaning Looms, Lifts and Spindle Rails by the Air Jet
Humidifying Systems
Automatic Sprinkler Systems
Air Lifts, Hoists and Motors
Moistening Goods

COTTON OIL MILLS
Cleaning Crusher Rolls and Separator Plates
Air Hoists, Lifts and Motors
Pumping Water
Operating Formers

CREOSOTING PLANTS
Wood Preserving Processes

CUT STONE AND MONUMENTAL YARDS
Running Stone Tools, Polishers, etc.
Lettering and Carving
Cleaning Carvings with the Air Jet
Air Hoists and Lifts
Running Plug Drills and Bush Hammers

DYE WORKS
Pumping Water
Agitating, Elevating and Transferring Dyes

ELECTRIC POWER AND LIGHTING PLANTS
Operating Air Hoists
Cleaning Engines and Generators with the Air Jet
Cleaning Boiler Flues
Calking Boilers

ELECTRIC RAILWAYS
Cleaning Motors and Generators with the Air Jet
Pneumatic Hammers and Drills
Air Hoists, Lifts and Jacks
Blowing Forges
Operating Pneumatic Tie Tampers
Cleaning Cars by the Air Jet
Pumping Water
Air Brakes
Storage Air Brake Systems
Switch and Signal Systems
Operating Car Doors
Tamping Track
Track Sanders
Cleaning Rails by the Sand Blast Preliminary to Electric Welding

ENAMELED IRON WORKS
Blowing or Spraying Enamel

FIRE STATIONS
Blowing Fire Whistles

FLAX MILLS
Pumping Water
Cleaning with the Air Jet
Cleaning Boiler Flues

FOUNDRIES
Operating Sand Rammers and Molding Machines
Pneumatic Hammers and Drills
Pneumatic Sand Sifter
Air Hoists, Lifts and Motors
Cleaning Castings by the Sand Blast
Blowing Out Cores
Drilling Salamanders
Aerating Metal in Bessemer Process

GAS WORKS
Operating Machine for Breaking down Hard Clinker in Generators
Starting Gas Engines
Compressing Carbonic Acid
Acetylene, Oxygen and other Gases (Compressors)

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Riveting and Calking Tanks
Calking and Testing Pipe Lines
Vaporizing Oil for Oil Engines
High Pressure Gas Transmission (Compressors)

GLASS WORKS
Pumping Glass Sand by the Return-Air System
Blowing Glass
Operating Molds and Presses
Supplying Oil Burners
Operating Sand Blasts
Etching Glass

GRAIN ELEVATORS
Drying Grain

HAT FACTORIES
Operating Presses
Cleaning Machines with the Air Jet

ICE AND REFRIGERATING PLANTS
Pumping and Aerating Water
Air Hoists for Ice Tanks
Air Hoist for Loading Cars
Scaling Condenser Coils
Cleaning Boiler Flues

IRRIGATION
Pumping Water by the Air Lift or Displacement Systems

JUTE MILLS
Pumping Water
Operating Air Hoists, Lifts and Motors

KNITTING MILLS
Pumping Water
Cleaning with the Air Jet
Agitating, Elevating and Transferring Solutions
Automatic Sprinkler Systems
Air Hoists, Lifts and Motors

MACHINE SHOPS
Pumping Water
Operating Pneumatic Hammers and Drills
Supplying Power Hammers, Air Hoists, Lifts and Jacks
Air Motors for Grinding, Buffing, etc.
Sand Blast for Cleaning Metals
Cleaning Machines with the Air Jet
Belt Shifters for Heavy Machine Tools
Punches and Presses
Pipe Bending Machines
Operating Pneumatic Chucks

MINING
Running Rock Drills and Hammer Drills
Return-Air System for Station and Sump Pumping
Unwatering by the Air Lift System
Air Hoists and Motors
Pneumatic Tools for the Repair Shop
Operating Air Brakes on Hoists
Unloading Cars
Running Direct-Acting Pumps
Drill Steel Sharpeners
Blowing Smith Fires
Oil Furnaces for Steel Sharpeners
Pile Drivers for Shaft Work

MUNICIPALITIES AND PUBLIC INSTITUTIONS
Pumping Water by the Air Lift or Return-Air System
Pumping Sewage
Testing and Calking Pipe Lines
Rock Drills in Road Construction
Rock Drill Sharpeners and Accessories
Blowing Fire Whistles
Filtration Plants

OFFICE BUILDINGS AND HOTELS
Sewage and Drainage Ejectors
Pneumatic Clocks
Operating Elevator Doors
Cleaning with the Air Jet
Dentist, Physician and Barber Service
Accumulator Systems
Pneumatic Tube Systems

OIL REFINERIES
Displacing and Transferring Oil
Agitating and Transferring Acids
Pneumatic Hammers and Drills
Calking Tanks and Pipe Lines
Air Hoists and Lifts
Oil Wells
Pumping by the Air Lift or Displacement Systems

PACKING HOUSE PLANTS
Pumping Water
Stuffing Sausages
Operating Belly Pounders
Lard Refineries
Air Hoists, Lifts and Motors

PAINT FACTORIES
Dressing Burr Stones
Agitating and Transferring Mixtures
Air Hoists and Lifts

PRINTING SHOPS
Monotype Machines
Air Hoists and Lifts
Cleaning by the Air Jet

QUARRIES
Rock Drills, Hammer Drills and Plug Drills
Stone Channelers
Air Hoists, Lifts and Motors

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Drainage Pumping by the Return-Air System
Operating Direct-Acting Pumps
Splitting Stone in the Bed

RAILROADS
Track Tamping
Starting Fires in Locomotives
Operating Pneumatic Hammers and Drills
Cleaning Flues
Calking Boilers and Tanks
Air Hoists, Lifts and Jacks
Air Brakes
Turn-Table Motors
Crossing Gates
Switch and Signal Systems
Sand Blast for Removing Paint, Cleaning Castings, etc.
Pneumatic Sand Rammers
Paint and Whitewash Spraying
Cleaning Cars, Furnishings, etc.
Transferring Oil
Pumping Water
Track Sander
Valve Setting Machines

ROAD BUILDING
Running Rock Drills and Plug Drills
Rock Drill Sharpeners and Accessories
Slushing
Portable Hoists

RUBBER FACTORIES
Testing Rubber
Inflating Rubber Tires
Porcupining Tires
Testing Tires, etc.
Air Hoists, Lifts and Motors

SALT MINES
Rock Drills and Plug Drills

SALT WELLS
Pumping Brine

SAND PITS
Pumping Sand by the Return-Air System

SAW MILLS
Operating Edgers, Bumpers, Pickups, etc.
Blowing Sawdust and Shavings from Machines
Pneumatic Haulage
Pumping Water
Automatic Sprinkler Systems

SEWAGE AND TRENCH WORK
Rock Drills and Hammer Drills
Sheet Pile Drivers
Calking and Testing Pipe Lines

SHIPYARDS AND BOAT BUILDERS
Pneumatic Hammers and Drills
Air Hoists, Lifts and Motors
Cleaning Plates and Castings by the Sand Blast
Pneumatic Painting
Starting Gasoline Engines
Riveting and Calking

SMELTERS AND ORE MILLS
Converter Tamping Machines
Air Hoists and Lifts
Blowing Converters
Agitating Cyanide Solution
Cleaning Cyanide Tanks by the Sand Blast
Calking Tanks
Handling Solutions

STEAM POWER PLANTS
Cleaning Boiler Flues
Calking Boilers
Pumping Water
Air Hoists and Lifts

STORE SERVICE
Pneumatic Cash Carriers
Cleaning by the Air Jet

STRUCTURAL WORKS
Pneumatic Tools for Drilling, Reaming, Chipping, Scaling, Riveting and Calking
Air Hoists
Pneumatic Punches
Pneumatic Paint Sprayers
Pneumatic Cement Gun (Sprayer)
Rock Drills and Plug Drills
Drainage Pumps

SUGAR REFINERIES
Agitating and Transferring Syrups
Pumping Water
Air Hoists and Lifts
Pressure Filters

TANNERIES
Pumping Water
Handling Tan Liquid
Air Hoists and Lifts

TEXTILE MILLS
Operating Humidifying Systems
Cleaning with the Air Jet
Moistening Stock by Spraying
Pumping by Air Lift or Displacement System
Operating Baling Presses

THEATRES AND HALLS
Cleaning with the Air Jet
Displacing Water

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Handling Scenery with the Air Hoist and Lift

U. S. GOVERNMENT
Pneumatic Tube Systems
Torpedo Charging
Ammunition Hoists
Pumping Water
Sand Blasts

WAREHOUSES AND STORAGE
Air Hoists and Lifts
Air Motors
Air Cleaning

WATCH FACTORIES
Blowing Dust, Chips, etc., with the Air Jet
Pneumatic Tools
Air Hoists and Motors

WATER WORKS
Pumping Water
Cleaning Boiler Flues
Calking Boilers and Tanks
Calking and Testing Pipe Lines
Sheet Pile Drivers
Plug Drills and Rock Drills for Trenching

WOODWORKING MILLS
Bending Wood

WOOLEN MILLS
Pumping Water
Agitating and Handling Dyes and Solutions
Cleaning Looms, Doffers and Spindles
Air Motors, Hoists and Lifts
Pressure Accumulators
Starting Gas and Gasoline Engines

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